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Other Contributor(s)	University of Hong Kong
Author(s)	Wong, Man-lun; 黃敏麟
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THE UNIVERSITY OF HONG KONG

AN EMPIRICAL STUDY OF THE DETERMINANTS OF CAPITALIZATION RATES IN HONG KONG: WITH REFERENCE TO CAPITAL MARKET RETURNS

A DISSERTATION SUBMITTED TO
THE FACULTY OF ARCHITECTURE
IN CANDIDACY FOR THE DEGREE OF
BACHELOR OF SCIENCE IN SURVEYING

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION

BY

WONG MAN LUN

HONG KONG

APRIL 2004

Declaration

I declare that this dissertation represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree diploma or other qualification.

Signed: Alan Wong

Name: Wong Man Lun

Date: 13-4-2004

Abstract

People in the real estate field make frequent use of capitalization (cap) rates to relate the rental income to the property value. In the income approach of valuation, the cap rate is used to estimate the property value from the net rental income. Because of the importance of the cap rate in the property profession, cap rates have long been the subject of many researches. This study aims to study the effect of different capital market returns on cap rates during different market conditions. Financial theories like Weighted Average Cost of Capital (WACC) and Capital Asset Pricing Model (CAPM) are used to set up the relationship between cap rates and capital market returns. Three sectors of the property market: Office, Industrial and Retail, are investigated from the period 1991 to 2003. This period is further sub-divided into 2 periods: 1991 to 1997 and 1998 to 2003. The results show that not all of the capital market returns will affect the cap rate in all market conditions. The return on equity is only significant in the slump market (1998 to 2003) while the cost of debt is always significantly related to the cap rate in all kind of market conditions. The result also shows that the relationship between the cap rate and equity return is negative rather than positive. It is hoped that the results can give more insights for the cap rate users in making their investment appraisals during different market conditions.

Acknowledgements

I would like to express my sincere gratitude to my supervisor, Dr. Frederik Pretorius, who spent much time and effort for guiding and giving inspirations to me throughout the preparation of this dissertation.

I would also like to take this opportunity to give my sincere thanks to my family and colleagues for their constant encouragement and support during the whole period, without which I can hardly complete this research study.

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Chapter 1

Introduction

1.1Introduction

Everyone working in the real estate field must have come across the word "capitalization rate" in their career life. In its simplest mathematical form, capitalization rate (cap rate) means the ratio between net operating income and the market value of a property. Through the cap rate, the rental value and property value are linked together. Property appraisers make frequent reference to the capitalization rate when they carry out valuation exercises. Using the cap rate to estimate the property value prevail against other valuation methods by its simplicity. The property value can be assessed easily by dividing the first year property net rental income by the cap rate. What's difficult in the whole valuation process is not the calculation itself but is the determination of cap rate. It is extremely important to have a correct cap rate as a very small error in the cap rate can make very great difference in the resulting estimated property value. Even 1% deviation in the cap rate can change the estimated property value for several hundred thousand dollars! However, determining capitalization rate is not an easy task; it is always controversial and easily being misunderstood. (Simpson, 2003).

Since the cap rate is so important in the real estate field, many researches have been

carried out before. Different perspectives have been used by different researchers in their studies of cap rate but their studies have only one common goal, i.e. to understand the factors affecting the cap rate. Most of the previous researches are done in other countries and they have got their own merits and inadequacies. This study aims to incorporate the merits of previous researches and study the determinants of cap rate in Hong Kong.

1.2 Scope of study and objectives

Many researches have been conducted to study cap rates but none of them is decided to study cap rates in different market conditions. The effect of the determinants during different market conditions is questionable. Therefore, the main focus of this study is to isolate the determinants of cap rate in Hong Kong during different market conditions. Following the logic of Jud and Winkler (1995), this study makes use of the concept of Weighted Average Cost of Capital and Capital Asset Pricing Model to study the relationship of cap rates with the capital market returns. In order to spot out the effect of the determinants in different property sectors, the study will be divided into 3 sectors: the office, industrial and retail sector.

This study will cover the period from the first quarter of 1991 to the forth quarter of 2003. Then, the period will be sub-divided into 2 periods: 1991 to 1997 and 1998 to

2003. Further researches will be carried out in these two periods as they represented the boom and slump property market in Hong Kong. The effect of the capital market returns on the capitalization rate during different market conditions will be investigated.

Under this theme, the objectives of this study are:

1) To examine the relationship between capitalization rates and other theories in the financial market, i.e. the Weighted Average Cost of Capital (WACC) and Capital Asset Pricing Model (CAPM)
2) To relate capitalization rates with the capital market returns in Hong Kong
3) To study the effect of capital market returns on cap rates during different market conditions, i.e. normal market cycle, boom market and slump market.

1.3 Organization of study

This study is to be divided into eight chapters, Chapter one is the introduction which gives the background, objectives and organization of this study. Chapter 2 will present the trend of capitalization rates in different property sectors in the period 1991 to 2003. The capital market returns such as the risk-free return, market return and best lending rate will also be given. Chapter 3 will study the theoretical concept of cap rate and other relevant theories used in the financial literature. Chapter 4 is the literature

review in which previous studies of cap rates will be reviewed. The research area of this study will then be identified in that Chapter. Chapter 5 is the methodology. The cap rate in Hong Kong will be studied with the cost of debt, return on equity and also the expected rental growth. Chapter 6 gives an account of the data employed in this study and the source of the data. Chapter 7 will present the empirical results and discuss the findings. Chapter 8 is the conclusion. The limitation of this study and the room for further investigations will also be discussed.

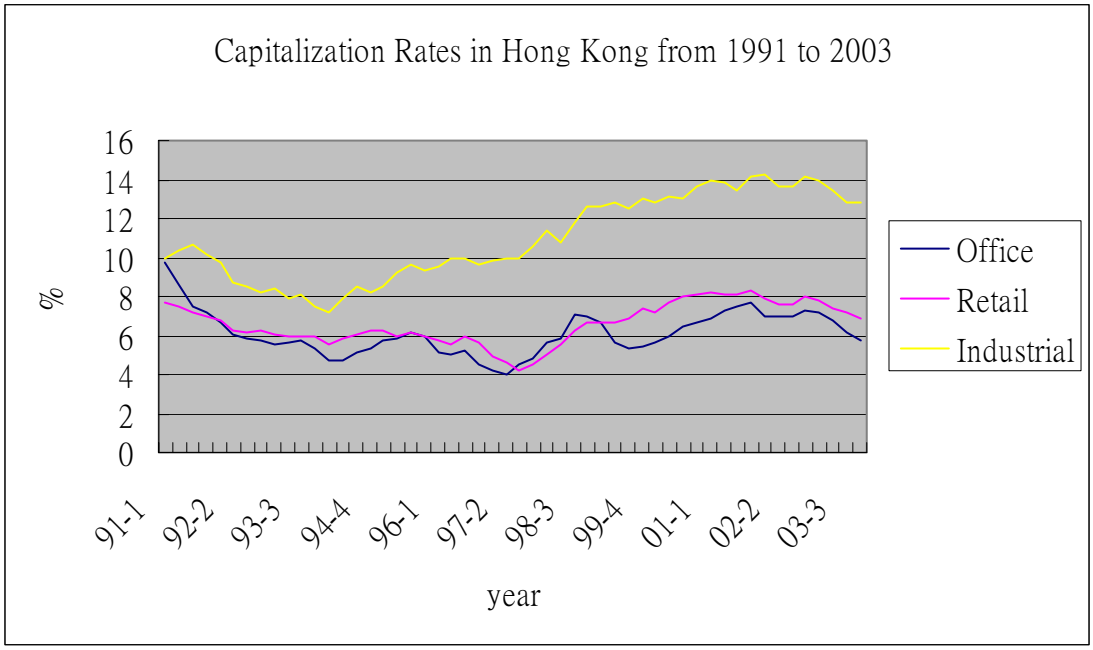
Chapter 2

Market Trend

2.1 Introduction

Before starting our investigation, let us have a look on some of the important figures in the property market. The capitalization rate of different property sectors will be presented from the first quarter of 1994 to the forth quarter of 2003. Other capital market returns such as the risk-free rate and best lending rate will also be investigated. The trend of Hang Seng Index will be presented to give a concept of the capital market return.

2.2 Capitalization rate

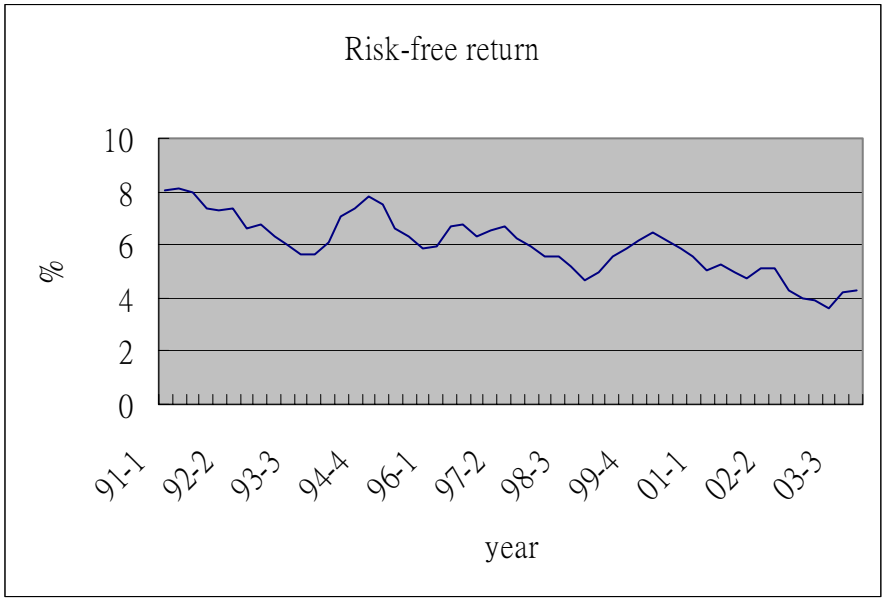


Source: *Rating and Valuation Department*

From the period 1991 to 1997, there is a general decreasing trend in the cap rate. It is due to the fact that the property price is increasing rapidly in that period. From the period after 1998, the cap rate is generally increasing with the decreased property price.

2.2 Capital market returns

Risk-free return

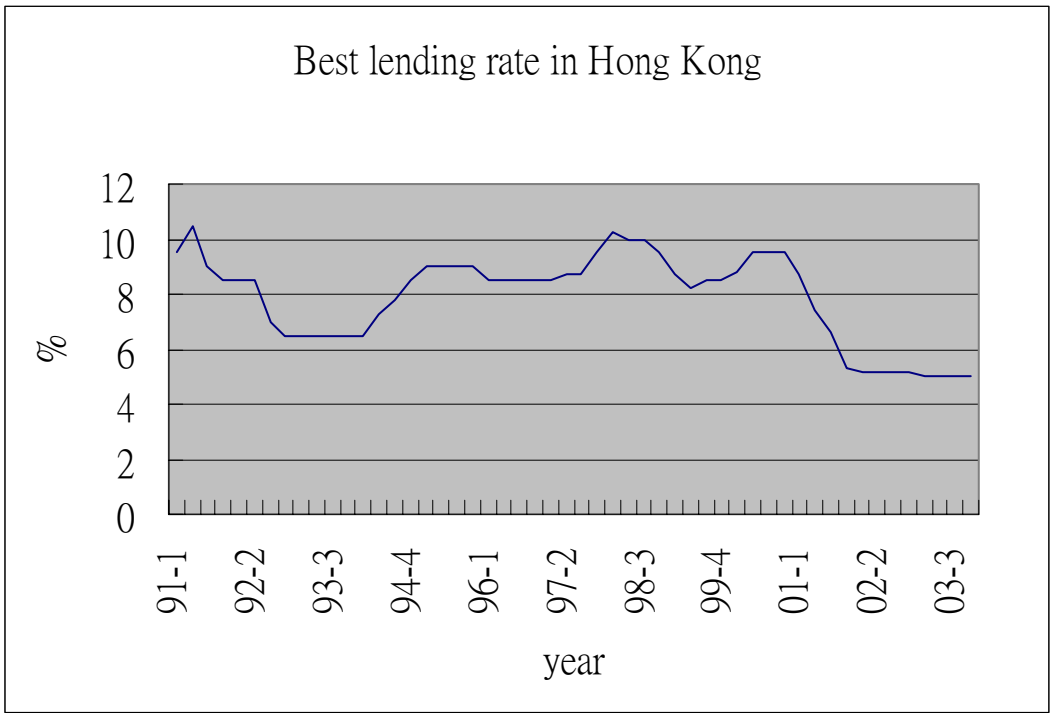


Source: *Federal Reserve Bulletin*

Risk-free return is proxy by the 10-year treasury rate in the United State. It is frequency referred as the risk-free return in the financial field because in theory, it does not have the risk of default.

Over the period from 1991 to 2003, there is a general trend of decreasing risk-free return rate.

Best lending rate

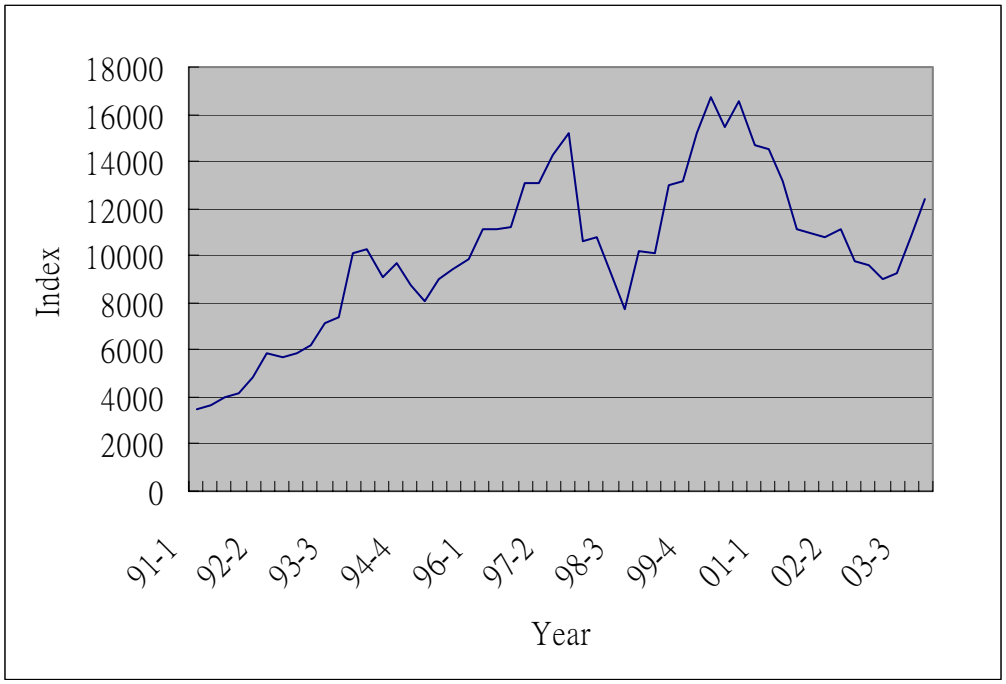


Source: *Hong Kong Census and Statistics Department.*

The best lending rate is generally following the interest rate determined by the Federal Reserve in the U.S. The rate is kept at a very low level since 2000 and there is no sign of increase up to the 4th quarter of 2003.

The best lending rate is considered to be one of the determinants of cap rate in Hong Kong. When people invest in properties, usually they have to finance the property price through mortgages. The interest rate charged by banks is the cost of their investments. Therefore, the interest rate will be an important factor for the property investors to decide the cap rate.

Hang Seng Index

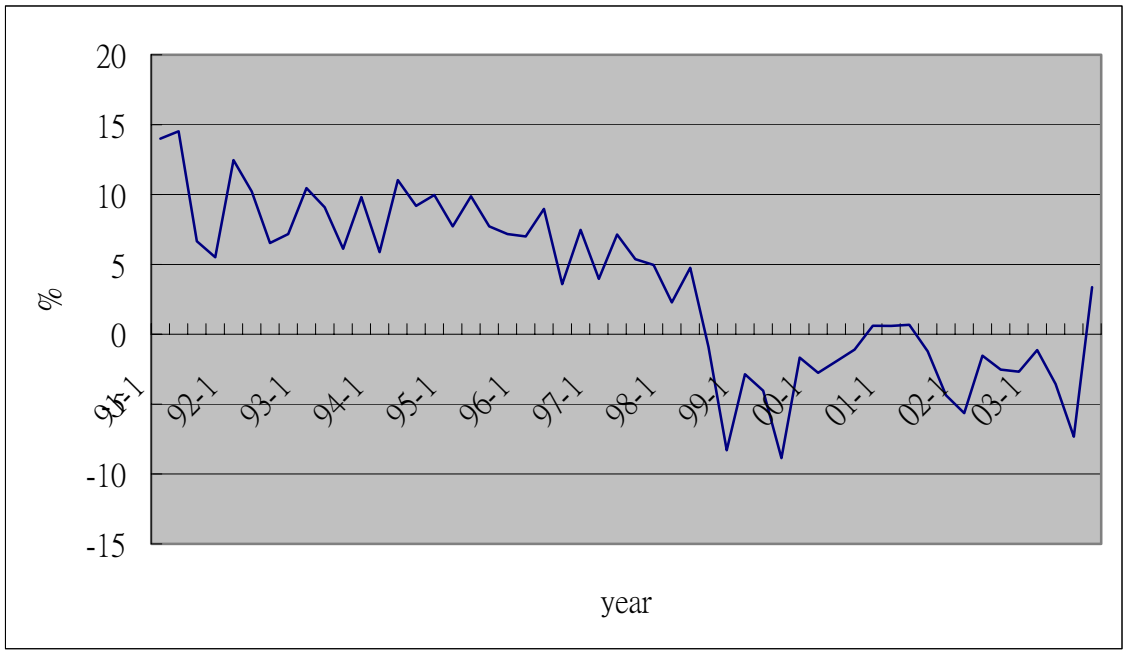


Source: *HIS Services Limited*

From the year 1991 to 1997, although there are seasonal fluctuations of the Hang Seng Index, the general trend of the index is increasing. After 1997, the market condition is very unstable. There is great drop in the stock market during the Asian financial crisis in 1998 and then the index rocketed to about 16000 during the tech-bubble in 2000. After that, the stock market drops again.

The return in the financial market is considered to be one of the factors affecting the cap rate in Hong Kong. As the investors will make comparison on their investment opportunities, the market return as proxy by the performance of Hang Seng Index is relevant in the determination of cap rates.

Inflation rate



Source: *Hong Kong Census and Statistics Department*

The inflation rate in Hong Kong is calculated from the composite consumer price index in Hong Kong. We can see that the inflation rate range around 10% for the period 1991 to 1997 and then turn to deflation since 1998.

The inflation rate is considered to be one of the determinants of the cap rate. People make frequent reference to the inflation rate when they try to project their future income. The inflation rate forms a good base for the estimation of people's expected rental growth.

The expected rental growth will proved to be relevant to the cap rate in the following chapters. In general, the cap rate is equal to the required rate of return minus expected rental growth.

Chapter 3

Theoretical Framework

3.1 Introduction

This Chapter aims to provide more theoretical background on cap rates and other theories in the financial context. It is crucial to our subsequent studies in the following chapters because our study model will base on the inter-relationship between the cap rates and capital market returns. Having a full and complete understanding of the relevant theories is a must for us to proceed to the subsequent chapters.

In this chapter, we will first examine the valuation method employed in the financial market, then, we will relate it to the real estate field. The financial theories of Weighted Average Cost of Capital (WACC) and Capital Asset Pricing Model (CAPM) will be discussed and we will demonstrate how those theories work in the real estate investment market.

3.2 Background

The capitalization rate (cap) rate is definitely one of the most frequently used terms in the real estate profession. The most simplified expression of cap rate refers to the ratio of net operating income to property value. With its simplicity, cap rate is frequently

used as a quick reference to estimate the value of property. As Brueggeman and Fisher (1993) stated, the income capitalization method converts the expected income stream from commercial property into an estimate of asset value by dividing the net operating income stream by the capitalization rate.

The Cap rate is so important that it attracts many investigations in the past. In recent decades, researches on cap rates have never been stopped. Researchers try to use different techniques and theories to test on the cap rate. Investigations are not bound in the property investment concept; many researches have incorporated different concepts from the financial market to study the cap rate. Froland (1987) tried to link up cap rates with the capital market. He argued that cap rates are in part a function of investor requirements for current returns, which means that they must be competitive with risk-adjusted money market returns of similar duration. Ambrose and Nourse (1993) formalized the idea of Froland and developed an investment approach based on the weighted average cost of capital (WACC) which is a concept widely used in the financial market for many years. Jud and Winkler (1995) moved a step forward to incorporate both the WACC and the capital asset pricing model (CAPM) into their investigation on cap rates.

WACC and CAPM are the two main theories in setting up the capitalization rate, thus, having a clear concept on those theories is a first step for us to carry out our

subsequent investigations. In this chapter, we are going to study the theoretical concept of cap rate, WACC and CAPM. Then, we can make use of the relationship between these three concepts to make up an investigation model for the cap rate.

3.3 Valuation of Stock

The valuation of a stock's today price is in a large extent similar to the valuation of real estate properties; so, let us first instigate how people come up with stocks' price.

The idea of Brealey and Myers (2003) showed that the value of a stock comes from the expected future cash payoff to owners. Such cash payoff comes in two forms: (1) cash dividends and (2) capital gains or losses. Suppose that the current price of a share is P_0, that the expected price at the end of a year is P_1, and the expected dividend per share is DIV_1, the rate of return of that investors expectation is calculated as follow:

$$\text{Expected return (r)} = \frac{DIV_1 + P_1 - P_0}{P_0}$$

This return that is expected by investors is often called the **market capitalization rate.**

Correspondingly, if we are given an investor's forecasts of dividend, price and the expected return offered by other equally risky stocks, we can predict today's stock price:

$$P_0 = \frac{DIV_1 + P_1}{1+r}$$

The price P_0 should be the maximum price that an investor is willing to pay for the investment. If the stock is priced above P_0, then the stock would offer an expected rate of return that is lower than other securities of equivalent risk. No one in the market will buy the stock and this will impose a downward pressure to the stock price and restore the price to P_0. If the stock is priced lower than P_0, people will rush to buy the stock and inflate the price of the stock back to P_0. All the securities in an equivalent risk class are priced to offer the same expected return. So, there will be an equilibrium price P_0.

If an investor is going to hold the stock for a period of time, he should have a series of forecasted dividends and the forecasted price of the stock at the end of his holding period. The stock price will come out from the following:

$$\begin{aligned} P_0 &= \frac{DIV_1}{(1+r)} + \frac{DIV_2}{(1+r)^2} + ... + \frac{DIV_H}{(1+r)^H} + \frac{P_H}{(1+r)^H} \\ &= \sum_{t=1}^{H} \frac{DIV_t}{(1+r)^t} + \frac{P_H}{(1+r)^H} \end{aligned}$$

It shows that the value of a stock comes from adding up the present value of the future dividends and the present value of the anticipated stock price at the end of the holding period.

If the investor intended to hold the stock for very long time, the second component (i.e. the present value of the anticipated stock price at the end of the holding period) of

the price model will become insignificant. As the holding period increase, $(1+r)^H$ will become larger and larger, finally making the whole term $\frac{P_H}{(1+r)^H}$ to become very minimal. The term that can significantly affect the price of the stock is the first component, i.e. the present value of the expected future dividends. Therefore, if an investor is going to hold the stock for a very long time, we can forget about the terminal price entirely and express today's price as the present value of a perpetual stream of cash dividends. This is usually written as

$$P_0 = \sum_{t=1}^{\infty} \frac{DIV_t}{(1+r)^t} \quad \textbf{(1)}$$

In other form, it is presented as:

PV (Stock)=PV (expected future dividends)

It means that present value of a stock is equal to the present value of the expected future dividends.

However, it is not the end of the story, since the above model is based on the forecast on the future dividend, any changes on the expectation of future dividend income will affect the present value of a stock. Let's first consider the case where there is no increase or decease of the expected dividend income.

Expected Dividend remains constant

If the expected dividend remains constant throughout the holding period of the stock,

there is no change of future dividend. The above formula applies:

$$P_0 = \sum_{t=1}^{\infty} \frac{DIV_t}{(1+r)^t}$$

When the holding period approach to infinity, the formula will become:

$$P_0 = \frac{DIV}{r} \quad \textbf{(2)}$$

Expected Constant Growth of Dividend

When there is expected constant growth of dividend income, the expected dividend to be received will follow the logic below:

$$DIV_1 = DIV_0(1+g)$$
$$DIV_2 = DIV_1(1+g) = DIV_0(1+g)^2$$

derive to ……..

$$DIV_t = DIV_0(1+g)^t$$

Using formula (1) in the above, the stock price is calculated as:

$$P_0 = \sum_{t=1}^{\infty} \frac{DIV_t}{(1+r)^t} \quad (1)$$
$$P_0 = \sum_{t=1}^{\infty} \frac{DIV_0(1+g)^t}{(1+r)^t}$$

when the holding period (t) approach to infinity

$$P_0 = \frac{DIV_1}{r-g} \quad \textbf{(3)}$$

Put it in another way, the market capitalization rate under the constant growth assumption equals:

$$r = \frac{DIV_1}{P_0} + g \quad \textbf{(4)}$$

which is equal to the dividend yield ($\frac{DIV_1}{P_0}$) plus the expected rate of growth in dividends (g).

3.4 Valuation of Property

Conventionally, there are two property valuation methods used by the property appraisers; the sale comparison approach and the income capitalization approach. The two methods analyze the value from different points of view and use different sources of data. Usually, these two methods are used concurrently so that the result come from one method can be used to counter check with the other one.

Sales Comparison Approach

The sales comparison approach makes use of the recent transaction record of similar properties to estimate the value of the subject property. The theoretical basis for this approach lies in the principle of substitution, under which investors are able to comparison-shop and set prices based on relative differences in properties. The reliability of this method depends on the quality of the comparable data found in the market and the ability of the appraisers to make adjustment over the differences of the properties. This method has been widely used in the property professions because it is easy and quick to use.

However, according to Li (1999), this method can provide reliable estimate of the property value only if the market is a normal one without an out-of-proportion influence of speculation. When the asset value is unreasonably and speculatively over-priced, market comparison can only provide a reference point for the market price in a very short time frame, without any indication of the market value of this asset, since there is a theoretical difference price and value.

Income Capitalization Approach

Income approach is one of the major valuation methods widely used by the property professions. The theoretical underpinning of income approach is built up by the valuation method developed in the finance market. Baum and Mackmin (1989) state that:

"The investment method is a method of estimating the present worth of the rights to future benefits to be derived from the ownership of a specific interest in a specific property under given market conditions…"

Li (1999) describes income approach as the summation of all future rental income. He explicitly relates the income approach to the appraisal techniques used in the financial world.

Application of the income approach involves analyzing the income producing

capabilities of a property, forecasting the periodic income and transforming the income expectations into a value estimate. There are two main income capitalization methods: **direct capitalization** and **yield capitalization**. Yield capitalization method makes use of the concept of discounted cash-flow analysis which involves the estimation of value by projecting the income or cash flow expected for the holding period. For the direct capitalization approach, it converts an estimate of a single year's income into an indication of value. It involves dividing the income estimate by an appropriate capitalization rate. For the purpose of our study, the direct capitalization method will be used.

Property valuation and Stock market valuation

When we carry out property valuation, the dividend income in financial market is analogy to the rental income while the holding period of the stock can be regarded as the holding period of properties. Although the ownership system used in Hong Kong is leasehold rather than freehold, the lease term is generally longer than 50 years. We can assume that the holding period of the investment property is very long as that we can ignore the present value from the sale of property at the end of the holding period. Similar to the valuation of stock, we can develop our model by focusing on the present value of the net rental value receivable in the future. Using the logic derived

from the above, we have got the new model for the property valuation:

$$V = \frac{NRI_t}{r}$$

Under constant income assumption, the value of a property is equal to the net rental value (NRI) of a property received in the first period divided by the required rate of return (r) of the investor.

This situation is generally unlikely to happen, because in a market, usually there is fluctuation of rental income and it is seldom to have constant rental income.

Under normal circumstances, investors would expect future increase of rental income as they did in the investment of stock, therefore, the value of a property should be:

$$V = \frac{NRI_1}{r - g}$$

Under the constant growth assumption, the value of a property is equal to the net rental value of a property received in the first period divided by the required rate of return minus expected growth of rental income.

The model basically contains 2 components, the initial rental income and the capitalization rate. The initial rental income can be found in the market easily, so what remains difficult in assessing the value of property is the capitalization rate.

3.5 Capitalization rate

Continuing from the above model ($V = \frac{NRI_1}{r-g}$), the capitalization rate is represented by the term "r-g", which means the required rate of return minus the growth rate. According to Li (1999), the capitalization rate depends on a set of assumptions each of which contributes to the final 'shape' of the figure. These include the growth factors during the term and reversion, rent review pattern, and risk element. Among all these, growth factor is especially important because it included all the implied-all-risk-yield for capitalization. The future movement should be taken into account of the calculation of cap rate because the capitalization process is based on a set of fixed future values. The cap rate involved in the capitalization process should be the required rate of return minus the growth rate of rental income.

Capitalization rate and discount rate

In doing the property valuation analysis, one would expect to face many variables and assumptions in their calculation in which the use of capitalization rate must be the most critical one. As we all know, the estimation of property value is based on the initial net rental value (NRI) divided by the cap rate (C), i.e.

$$P_0 = \frac{NRI_1}{C}$$

A very small error in the estimation of cap rate will make major difference on the resulted property price. Many property appraisers are puzzle with the use of

capitalization rate and discount rate. Some early studies like Ambrose and Nourse(1993) simply equate the capitalization rates and discount rates. However, many subsequent studies like Brueggeman and Fisher (1993), Jud and Winkler (1995), have identified that cap rate is not the same as the internal rate of return on the property investment as the cap rate does not consider changes in projected future incomes. The concept of capitalization rate is based on the initial net rental income. Obviously, if we hold a property for a long period of time, say 50 years, we would reasonably expect increase in the rental income over the 50 years time. Therefore, the expected increase in the rental income can compensate some of the required rate of return of investors as the investors can get higher income in the subsequent periods. The relationship of cap rate(C) and required rate of return (r) should be:

$$C = r - g$$

Capitalization rate as an income multiplier

Now, let's go back to our valuation model:

$$P_0 = \frac{NRI_1}{C}$$

Rearrange it into:

$$P_0 = NRI_1\left(\frac{1}{C}\right)$$

The term $\frac{1}{C}$ is the reciprocal of capitalization rate, it is commonly known as the **Gross Income Multiplier**. It represents the present value of a series of 1 dollar receivable at the end of each year perpetually. The capitalization process usually makes use of this income multiplier. By multiplying the income multiplier to the initial annual rental income, one can easily get a rough estimate of the property value.

In terms of the required rate of return and expected future growth, the income multiplier is represented as:

$$\frac{1}{r-g}$$

The income multiplier clearly shows the inter-relationship that the lower the cap rate, the higher the estimated value of the property and vice versa.

Price to earnings ratio and cap rate

People in the investment field usually compare the price to earnings (P/E) ratio, which is widely used in the stock and finance market, with the cap rate. The P/E ratio is the most fundamental reference that the stock investors and analysts will use before they buy any stock.

$$\text{P/E ratio} = \frac{stock\_price}{earnings\_per\_share}$$

Sometimes the P/E ratio is useful in evaluating stock price. Suppose an investor owned some shares in a private company, because the shares are not publicly traded in

the stock market, it is very difficult to assess the value of the stock. The investor can find a firm which is listed on the stock market and having roughly the same profitability, risks, and growth opportunities as his firm. Then, the investor can estimate the value of his share by multiplying the P/E ratio of the listed company with his company's earnings per share.

Petros et al (2001) think that, higher P/E signal greater expected growth and less uncertainty, while lower P/E implies the reverse. They found that cap rate move exactly as PE do if appraisers form expectations about future income growth by looking myopically backward and not forward. The cap rate in the real estate market can be used in similar way as the P/E ratio in the stock market. As mentioned above, the reciprocal of cap rate is the income multiplier. The income multiplier times the net rental income can also be used to estimate the value of properties.

However, Brealey and Myers (1991) remind that the P/E ratio has to be used carefully because it is difficult to interpret. Higher P/E ratio may not mean higher growth opportunity but is resulted from too low earnings per share. Also, the accounting method used in calculating earnings can also affect the P/E ratio. Therefore, the P/E ratio has to be used with caution.

3.6 Weighted Average Cost of Capital

Weighted average cost of capital (WACC) is the rate of discount that reflects the average costs of debt and equity capital employed by a firm. It reflects the cost of a firm in raising its capital to finance its projects. Usually, a firm can raise capital by 2 means, one is by the equity input by the investors and the other is by raising debt. If an investor chooses to buy the share of a company, he is the equity owner of the company. The equity owner will require a certain amount of return on the money he invested in the company, this kind of required return on equity is regarded as the cost of shareholders' fund in the company's point of view. If a company is totally financed by the investment of shareholders, the cost of capital of the company will be the same as the required return of the investors. However, in the normal business world, companies are usually financed by both equity investment and debts. When companies need to raise capital to finance their projects, they may choose to borrow it from someone else instead of using their own money. They can do so by borrowing from banks, issuing bonds or debentures. Of course, the borrowing of debt is not without cost, the company has to pay interest to their creditors. The interest is the cost of borrowing.

The concept of WACC is that, the cost of capital of a firm is calculated by the weighted average cost of equity and cost of debt of a firm. Let us first ignore the

effect of taxation and study the simplest form of WACC:

$$WACC = K_E \frac{E}{V} + K_D \frac{D}{V}$$

K_E = expected rate of return of the investors of the firm

K_D = the firm's current borrowing rate

D,E = the market values of currently outstanding debt and equity

V = D + E = the total value of the firm

By using WACC, a firm will know what the cost of firm's money is. When a company has got some potential projects, WACC is frequently used to assess the required rate of return of the projects. A company will not accept projects having lower return than the WACC because the gain from the project cannot compensate the cost used to finance the project. One important point to make here is that, the WACC should be used to assess the projects which are in similar nature of the firm's existing projects only. For the projects having lesser or higher risk than the existing project, or materially different from the existing projects of the firm, WACC has to be adjusted according to different natures of projects.

Capital Structure (Gearing)

WACC reflects the cost of capital of a firm, if the WACC is lowered, more projects will become feasible and the firm can make more profit. People will then easily come up with the question that how can a firm lower its WACC?

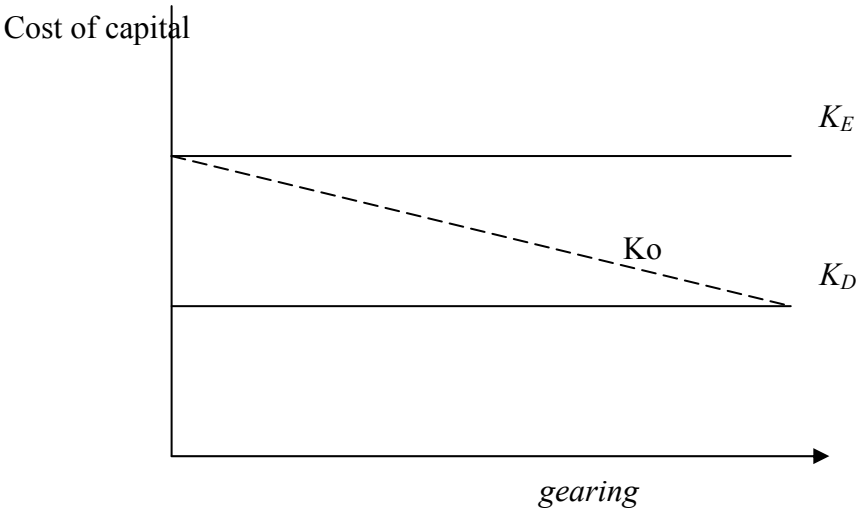
As we have reviewed in the above, WACC is the weighted average cost of debt and equity. The cost of debt and equity of a firm are usually fixed and cannot be changed easily. What remain flexible is the relative mix of the debt and equity in a firm. Different schools of thought have been evolved and they take different views on the capital structure of a firm. Let's have a look of some of them.

The Net Income Approach

This approach proposes that the average cost of capital declines as the weighting of debt in the capital structure increase. i.e. higher gearing. It takes the view that cost of equity is independent of the cost of debt. That means, increasing the weighting of debt will not affect the cost of debt and equity. The cost of equity and cost of debt are kept constant.

Usually, the cost of debt is lower than the cost of equity. It is based on the rationale that debt holders are less risky than the equity owners. The debt holders are ranked higher than equity owners in case of bankruptcy; therefore, they are safer than the equity owner and will require lower returns on their money.

As the cost of debt is lower than that of equity, a company can lower its WACC by increasing the relative weighting of debt in the capital structure. The relationship of WACC (Ko), cost of equity (K_E), cost of debt (K_D)and gearing is shown in the graph:

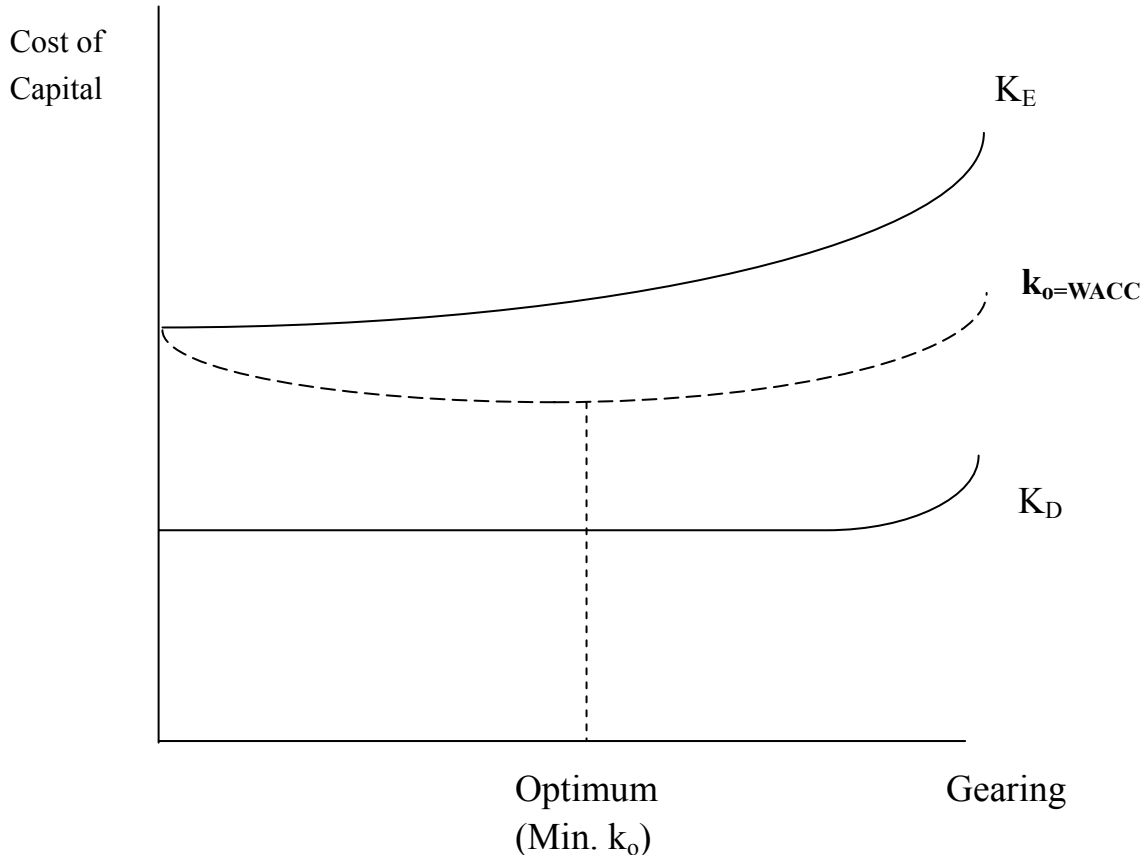


The Traditional Approach

The traditional approach takes the view that there is an optimal capital structure. It first follows the view of net income approach, by taking advantage of the lower cost of debt; the company can achieve lower WACC. However, the decease of WACC is not unlimited. The WACC will decrease as the gearing increase up to a certain level and then it will increase again.

Increasing debt to a company is not free of cost. First, the debt, unlike equity, needs to be repaid within certain period of time. Second, the debt involves interest cost. More debt means that the company needs to spare more money to repay for the debt and interest. It will increase the risk of a company as she borrows more. The equity holder will then request more on the return on equity in order to compensate for the higher risk. When the company continues to borrow, the increase in required return on equity

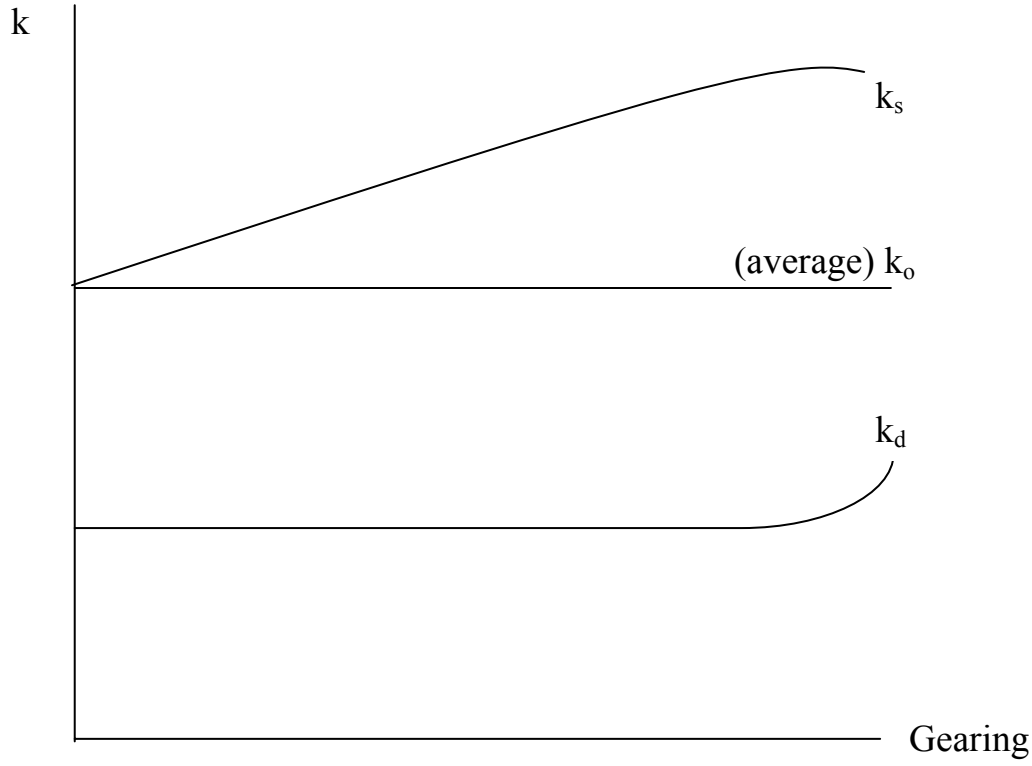
will offset the lower cost of debt and finally increase the resultant WACC. Also, the cost of debt will increase eventually as the company increase her debt. The borrower will be reluctant to lend more to the company when she has already borrowed a lot. Higher interest payment is required to persuade the borrower to continue lending to the company. Therefore, the WACC will move as follows:



Modigliani and Miller Theory

Modigliani and Miller (MM) favor the net operating income approach that WACC is constant. In their famous "proposition I", they state that a firm cannot change the total value of its securities just by splitting its cash flows into different streams: The firm's value is determined by its real assets, not by the securities it issues. MM's proposition I allows complete separation of investment and financing decisions. Brealey and Myers (1991) explained, as the investors can borrow or lend on their own account on the same terms as the firm, they can "undo" the effect of any changes in the firm's capital structure. Therefore, the market value of any firm is independent of its capital structure.

In MM's proposition II, they further illustrate that the expected return on equity increases with the debt-equity ratio increase. When a company increases gearing, she takes advantage of lower cost of debt. At the same time, the required return on equity will be increased too, because higher gearing increased the risk of the company. The cheaper cost of debt is completely offset by the increase in cost of equity. Therefore, WACC will remain unchanged. The cost of debt will eventually increase too as the higher leverage increases the risk of debt. Debt holders will demand a higher return on debt. The relationship is demonstrated as follows:



Traditional approach and MM proposition

The traditional approach and Modigliani and Miller theory result to different conclusions on the capital structure. The traditional approach hold a view that there is an optimal capital sturcture while the MM propositions support that the total market value of a firm is independent of its capital sturcture. The major arguments come from the different set of assumptions of the two approachs. If we lift their assumptions and put it into the real world, both approachs agree that there will be an optimum capital sturcture of a firm. Since in the real world, there is tax being imposed on the firms. If the firms are profit making, they should pay taxes. Therefore, we have to consider the effect of taxation when we consider the capital structure.

Tax shield effect

With the introduction of tax, the correct form of WACC should be like this:

$$WACC = K_E \frac{E}{V} + K_D (1 - T) \frac{D}{V}$$

T = corporate tax rate

When we raise capital by issuing debt, interest expense is incurred. In most cities including Hong Kong, the interest expense incurred in the production of taxable income is tax deductible. Therefore, a firm can pay less tax if they incur interest expense. The interest pay to the creditors will then be lowered by the tax saved. The effective cost on debt will be lower than the interest rate charged by the creditors. Modigliani and Miller agree that the tax allowance is actually subsidizing the firm in paying debt. Thus, the higher debt a firm raise, the more subsidization she can get and the better the firm is. The WACC can be reduced by increasing debt until the point that increase in the require return of equity exceed the tax benefit. This implies there is an optimal capital structure.

We can see that both the traditional and Modigliani – Miller agree that there is an optimal capital structure in the real world.

Optimal Capital Structure

In the absence of perfect capital markets and with the existence of corporate taxes, an optimal structure is implied by both the M-M and the traditional view. The problem

remain is how to achieve an optimal structure. As we have discussed above, higher weighting on debt can enjoy the benefit of lower required return and tax allowance. At the same time, increased gearing will increase the fixed finance fee of a company and increase the dangerous of bankruptcy. The optimal capital structure depends much on the trade off between tax benefit and increased risk. Also, the attitude of the management plays an important role on the determination of capital structure. Company managements may sometimes reluctant to increase company's gearing to achieve an optimal capital structure as they perceive less job security with higher gearing. There is no universal capital structure which is the best for every firm because each firm has to consider their own strength, corporate strategy and culture to develop their optimum capital structure.

Capitalization rate and WACC

Jud and Winkler (1995) assert that cap rate bears a close relation to the weighted average cost of capital as defined in the corporate finance literature. As WACC can be used to assess the minimum rate of return required for a project and the capitalization rate equal to the require rate of return minus the growth rate. Then, the capitalization rate can also be defined as WACC minus the growth rate:

$$C = WACC - g$$

3.7 Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) was developed based on the Modern Portfolio Theory (MPT) which introduces the concept of portfolio investment. The main concept of the MPT is that if an investor invests in a number of securities to form a portfolio rather than investing in only one asset, he can gain higher return with the same level of risk or he can gain the same level of return with lower risk. The performance of the portfolio in lowering risk depends on the correlation of the different investments in the portfolio. The more negative the correlation between the investments, the lower the cost will be.

The CAPM develop further from the MPT, it set up a formal model to assess the expected return of an asset. The model categorizes risk into the systematic risk and unsystematic risk. The systematic risk is the inherent risk of investment which is incurred in the market. This risk cannot be avoided by diversifying the investment. In contrast, the unsystematic risk is the risk that is specific to a particular investment. Therefore, the unsystematic risk should be able to eliminate by diversifying investment. In a well diversified portfolio, the only risk involved should be the systematic risk.

Assume there are an investment j and a market portfolio m

The total risk (δ_j) = Systematic Risk + Unsystematic Risk

$$\delta_j^2 = r_{jm}^2 \delta_j^2 + (1 - r_{jm}^2)\delta_j^2$$

If correlation of returns between market and investment J is perfect, all risk is systematic. In contrast, if there is no correlation between the market and the investment J, all risk is unsystematic.

We know that the market portfolio M is fully diversified and efficient. M is also perfectly correlated with itself. All the risk is therefore systematic risk and all unsystematic risk has been diversified away.

The perfectly diversified investor can thus totally ignore the unsystematic risk of each individual asset in her market portfolio. The only "true risk" that these assets have is systematic risk, because perfect diversification eliminates all unsystematic risk.

This means that the total risk of an asset is not the relevant measure of risk in a portfolio context, only the market risk is relevant. It is measured by an expression known as the asset's Beta:

$$\beta_j = \frac{r_{jm}\delta_j}{\delta_m}$$

Beta-j (β_j) is an index of systematic risk, and measures an asset's systematic risk relative to the total risk of the market (M). Because the Beta is an index of systematic risk relative to the market portfolio, the Beta of the market is 1

CAPM and expected return

CAPM has been widely used in the financial market to estimate the expected return of an investment. The theoretical underpinning is that the expected return of an investment is equal to the risk-free return plus risk premium. We can see that the expected return is divided into two parts, one is the risk-free return and the other is the risk premium. The risk-free return is fundamental to every investment because the investor can get certain return by investing in the risk-free return. If the return of an investment is lower than that of the risk-free return, no one will invest in such asset because he can get higher return from the risk-free investment and also there is no risk involved. The risk-free return is usually referred to the U.S. government bond because there is no risk of default. The risk premium is the additional return required by investors to compensate for the higher risk involved in the investment. The premiums have to be adjusted according to the corresponding risk of the investments. Obviously, more risky investments will require higher risk premium.

The above concept is presented by the equation:

$$r_i = r_f + (r_M - r_f)\beta_i$$

r_i denotes the expected return on security i

r_f denotes the risk-free return

r_M denotes the expected return on the market portfolio

β_i denote the systematic risk of security i relative to the market risk

As the information of market return, risk-free return and Beta are usually available; the investors can estimate the expected return of an asset by using CAPM.

3.8 Relationship between Capitalization rate, WACC and CAPM

In the above, we have reviewed that Capitalization rate is equal to the required rate of return minus expected growth rate. WACC can be used to estimate the required rate of return. Then,

Cap rate (C) = WACC-g

WACC contains two components, the cost of debt and cost of equity. The cost of debt can be obtained in the market. We can refer to the lending rate in the bank or the bond rate of the company to determine the cost of debt. What remains uncertain is the cost of equity. The cost of equity represents the required rate of return of investors. Therefore, the CAPM is useful in determining the equity part of WACC.

We can see that, there is a step by step relationship between cap rate, WACC and CAPM. In fact, the relationship forms the basis of our study. In the following, I will develop a model of capitalization rate following the logic of WACC and CAPM.

Before that, let's have a look of the previous researches on capitalization rate.

Chapter 4

Literature Review

4.1 Introduction

After reviewing the theoretical concept of the relevant matters concerning capitalization rates, we can now move on to discuss some of the previous researches on cap rates. In this chapter I would analyze the research methods and research areas employed by different researchers. Then, I will spot out the merits and drawbacks in those researches. Finally, I will develop my own research model based on the previous researches

4.2 Background.

In the property profession, the term capitalization rate (cap rate) perhaps is the most widely used term that every property appraiser will come across every day. In theory, the use of cap rate to estimate the property value is very easy. We just need to divide the net operating income of the property by the cap rate, then we can get the estimated property value. However, in practice, what is the most difficult part is not the calculation, but the determination of cap rate. As Chai (1996) states, capitalization rate is the most difficult piece of information to obtain in the whole valuation process.

As capitalization rate is so important in the property valuation, lots of researches have been carried out, aiming to get more insights on the factors affecting the capitalization rate and understanding the nature of it.

The research focuses and research methods on cap rate have been very diverse. Some researchers,(Parker, 1994; Chai, 1996), are focused on the micro-valuation aspect, while some other researchers, (Major, 1990; Mooey, 1998) focus their researches on macro-economic factors. Some of them try to relate the cap rate to various market variables such as tenant quality and lease conditions.(Mooney, 1998). Other researches try to employ the theories in the financial market and incorporate them into the cap rate (Ambrose and Nourse, 1993; Jud and Winkler, 1995). In the following, I will analyze the previous researches and then develop my own research space by spotting out the merits and inadequacies of previous researches.

4.3 Definition of capitalization rate

The definition of capitalization rate employed by the previous researches has been quite consistent. Bokoske (2003) stated that capitalization rate is a composite rate used for converting income into a property value. It is analogy to the meaning used in some other literatures (Jud and Winkler, 1995; Petros et al, 2001) that cap rate is equal to the net operating income divided by the property value. The difference in the

terminology does not affect the understanding of cap rate as Bokoske's definition is from the income capitalization point of view, while other literatures just reconcile the cap rate into its component of net operating income and property value.

Although the researches have a common understanding on the cap rate, but different researches have different approaches to study the cap rate. Let's review some of them in the followings.

4.4 Market variables

Parker (1994) created a hierarchical framework on the determinants of the capitalization rate. The author sends questionnaires to 65 experienced property appraisers, who had carried out 4700 property valuations in previous years, to rank 12 market variables in determining the cap rate. The result showed that there are 5 primary determinants that the property appraisers concern most, they are: Tenant, Growth, Risk, State of Property market and location. The result given by the property appraisers is based on the experience of the appraisers. It can give certain insights on the determinants of cap rate as experiences usually mean past data and records incorporated in the memory of the appraisers.

However, as there are no empirical testes supporting the findings, the result does not tell how the determinants affect the cap rate. More importantly, it ignores the

interrelationship between each determinant.

In contrast, Mooney et al (1998) did a similar research on the single-tenant properties. They incorporated a regression model to test 3 factors affecting the cap rate. They find that 90% of the variation of cap rate can be explained by tenant quality, market assessment of the risk of tenant and the number of step-ups in the lease term.

However, major drawback of both Parker(1994) and Mooney et al (1998) is that, there is not any theoretical framework supporting the relationship of the subject factors with the tenants. The authors tend to use their own experience to judge the correlations.

4.5 Introducing capital market concepts

Froland (1987) could be regarded as one of the pioneers to explain cap rates in terms of macroeconomic factors. He tried to introduce the concept of capital market returns in the analysis of cap rate and argue that cap rates are in part a function of investor requirements for current returns, which means that they must be competitive with risk-adjusted money market returns of similar duration. In addition, cap rates reflect the ownership of a real asset and, by implication, an expectation of equity appreciation upon sale. Returns based on this expectation must also be priced competitively with alternative equity markets. Under Froland's philosophy, the cap rate has 3 components, (1) the debt yield (2) the equity return requirement and (3) the

inflationary expectations.

In his findings, there is a strong correlation of the cap rate with mortgage rates, ten-year bond rates and the earnings/price ratio. Also, the inflationary expectations as measured by the Treasury bond-bill spread were inversely related to cap rates. Using a stepwise regression approach, about 86% to 95% of the variation in cap rates is explained by the mortgage rate, the eight-quarter bond-bill spread, and the price earnings ratio.

The study of Froland (1987) formed a stepping stone for later researchers to investigate cap rate. Although Froland's empirical results are not well supported by a theoretical framework and he missed out the tests on autocorrelation in his study, he has successfully related the cap rate with capital market returns. Subsequent to Froland's work, Lai (1996) used a similar approach as Froland to investigate the cap rate in Hong Kong. He tries to relate the cap rate with a basket of variables including the capital market returns and the non-capital one. He has successfully related the cap rate with the Hang Seng Index, best lend rate, deposit interest rate, risk free rate, expected growth, political confidence, etc. His model is able to explain 80% of the variation in the cap rate. His study is better than that of Froland's one as he is able to conduct the Dubin-Watson statistic which confirmed that his variables have no auto-regression. However, just similar to Froland's work, Lai's work is lack of any

theoretical framework to support his model. The problem of lacking theoretical supporting cannot be solved until the introduction of some concepts in the financial market.

4.6 Introducing Weighted Average Cost of Capital

The Weighted Average Cost of Capital (WACC) has been developed in the financial market for many years. As proved by Copeland and Weston (1988), the cap rate bears a close relation to the WACC as defined in the corporate finance literature.

With the introduction of WACC, Ambrose and Nourse (1993) make a step forward from Froland's(1987) work by incorporating the WACC into their model. Ambrose and Norse (1993) agreed with Froland (1987) that the real estate equity yields and mortgage interest rates must be related to other relates in the capital market since investors can substitute across investment types. The yields in the stock market would be related to equity yields in real estate, and the mortgage interest rates should be related to the return of government or corporate debt. Therefore, they use the stock market earnings to price ratio and the risk premium on long-term debt to relate to cap rate. What is different from the Froland's work is the introduction of the WACC which is in the form like this:

$$R = [LTV * MC] + [(1 - LTV) * ROE]$$

R is the capitalization rate, LTV is the mortgage loan-to-value ratio, MC is the mortgage constant, and ROE is the return on equity.

Developing from the WACC, Ambrose and Nourse(1993) built up a model which related cap rate to the spread between long-term and short-term government bond rates, the earnings/price ratio of the S&P 500, and debt-to-equity components. They used both the seemingly unrelated regression (SUR) and panel data regression methods to test the variables and find that panel data regression gave a better result. The model suggests that cap rates are negatively related to stock earnings/price ratios. Surprisingly, the results also show that the cap rate is positively related to expected inflation. It is contrary to the results of Froland (1987) and Lai (1996) in which both of them show an inverse relationship between cap rates and the expected inflation. The reason for the discrepancy may due to the mistake committed by Ambrose and Nourse in equating WACC to cap rate. As suggested by Chai (1996) and Johnson (2001), capitalization rate should be equal to WACC minus expected growth rate. Also, the expected growth rate is in a large extent estimated by the expected inflation rate.

Capital Structure

As we have reviewed in the previous chapter, when we introduce WACC concept into

our analysis, we have to consider the capital structure, too. A lot of analysis on different hypothesis of capital structure has been carried out and some of the researches in cap rate have also addressed this point. Netting (2002) followed the logic of the famous Modigliani Miller theorem and suggested that valuation of property should be independent of its financing.

4.7 Introducing Capital Asset Pricing Model

Following the introduction of WACC, people try to incorporate more financial theory from the financial market to study cap rate. The Capital Asset Pricing Model (CAPM) was introduced to the financial market by Sharpe in 1964, after that, people in the stock market widely accepted CAPM method to empirically estimate the cost of equity.

Corgel (2003) implicitly incorporated the concept of CAPM into his analysis of cap rate. He analyzed the risk return associated with the cap rate into 2 components. One is for the risk free return and the other is risk premium. He finds that the risk free return and risk premium can actually move in different directions according to the macro-economic factors. However, Corgel did not include the WACC into his model. Therefore, he missed out the return on debt in his analysis.

Working on the basis of Froland (1987), Evans(1990) and Ambrose and Nourse

(1993), Jud and Winkler (1995) developed a comprehensive model which made use of the WACC and CAPM to explain the variation in cap rate. Unlike Ambrose and Nourse (1993), Jud and Winkler correctly interpreted cap rate as WACC minus growth rate. They analyzed the excess cap rate in two major components: the debt spread and equity spread. The excess cap rate is calculated by capitalization rate minus the annualized three-month Treasury bill rate. The debt spread is proxy by the difference between the return on BAA-rated debt and the annualized three month Treasury bill rate. The equity spread is proxy by the total return on the Standard and Poor's 500 Index minus the annualized three-month Treasury bill rate. The results showed that the real estate cap rates are greatly influenced by capital market returns. The capitalization rates were positively related to both the cost of debt and cost of equity.

The model developed by Jud and Winkler(1995) is a good reference for subsequent researches because it has incorporated many merits from previous researches. First, it followed the logic of Ambrose and Norse (1993) that the study of cap rate should be separated according to the property type and location. Ambrose and Norse suggested that the capitalization rate should be a function of property characteristics and alternative investment returns. Property characteristics will vary across both property types and location. Their result showed that differences across property types are important in evaluating cap rates. This result is supported by Corgel (2003), he found

that different property types will have different relationships with the financial market. This will lead to different performance of cap rate in different property type in response to the changes in financial market. The idea can be formalized by the study of Brown (1984) in which he found that different property types will have different covariance with the investment market. The beta value of each sub-sector was found to be different.

The previous researches supported Jud and Winkler's (1995) model in dividing the study into different property types. It was better than the previous analysis of Froland (1987) in which he used an integrated cap rate instead of property type specified cap rate.

4.8 Information Inefficiency of the property market

The similarities between the property market and the stock market make it feasible to adopt the theoretical framework in the financial market to study cap rate. However, there are some intrinsic differences between them and such differences will require adjustment to be made in studying cap rate. The speed of information flow and reaction to inflation changes are important issues to be addressed in the study of cap rate. Usually, people in the stock market recreate quickly to the information like interest rate change. The effect of the information can be reflected in the performance

of stock market almost immediately after disclosure of information. In contrast, the reaction time for the property market is much slower.

Not many studies have addressed this difference. Many of the previous studies did not take into account the information inefficiency in the property market and directly related the cap rate with the current interest rate and capital market return. (Froland, 1987 ; Ambrose and Nourse, 1993, Petros et al, 2001, etc.) This will affect the accuracy of their studies.

Evans (1990) did a transfer function analysis on cap rate and he showed that the sensitivity of the cap rate lag the stock market by one quarter. Following the logic of Evans (1990), Jud and Winkler (1995) inculed one- and two- period lags for market variables. The recent research of Chin (2001) further addressed that the response of cap rate may lag the market variables up to 8 quarters. The results indicated that subsequent researches should include adjustment of response lag.

4.9 Further Research Area

The research done by Jud and Winkler (1995) is a good starting point for subsequent researchers who want to study the cap rates in the financial point of view. Their model demonstrated a clear linkage between cap rates and the capital market returns. By incorporating the WACC and CAPM into their work, the relationship between cap rate

and the capital market return were well supported by the long established theories. Insights from previous researches have also been addressed. The lagging effect and differentiation of property types were being addressed in their study. However, their model missed out an important factor, i.e. the expected growth rate. From the previous chapter, we should know that the expected growth rate is essential to cap rate. Despite this point, the work by Jud and Winkler (1995) do give many inspirations for subsequent researches.

Chin (2001) tried to follow the logic of Jud and Winkler to study the cap rate in Hong Kong. Moving one step forward from Jud and Winkler's work, Chin (2001) included an explicit growth rate variable in her study. The result confirmed the assumption that expected growth rate move in the opposite direction of cap rate. However, her result on other capital market returns did not confirm with the results in previous researches. (Forland, 1987; Evans, 1990, Ambrose and Nourse (1993), etc) She cannot find a significant correlation between the cap rate and interest rate spread in Hong Kong. This result may be due to the testing period used by Chan in developing her model in which she studied the data from 1980 to 1998. In this period, the property market is highly speculative; the investors may not perform rationally in making their investment decision.

Another problem of Chin's study is the ignorance of the capital structure of investors.

As we have studied in previous chapter, the capital structures do influence the WACC of investors. It will in turn affect the cap rate. Therefore, capital structure should not be excluded in the study of cap rate.

4.10 Conclusion

In this chapter, we have reviewed many studies on cap rates. Some are done in the micro-valuation aspect and the others are from the macro-economic point of view. Many researches have been done on the capital market return but they are short of strong theoretical framework. Starting from the introduction of WACC and CAPM, the investigation on capitalization rates has entered into a new era. Researchers try to formalize the correlation of cap rate with the financial market. Jud and Winkler(1995) has set a good foundation for our studies and Chin (2001) has made a good try to study cap rate in Hong Kong. However, none of the previous research has studied the effect of the determinants during different market conditions. By addressing the merits and inadequacies of the previous studies in this chapter, I am now going to develop my model to study the cap rate in Hong Kong.

Chapter 5

Methodology

5.1 Introduction

In Chapter 4, we have reviewed previous researches on cap rate. The merits and inadequacy of the studies have been identified. In this chapter, I am going to develop a study model, tailor to Hong Kong. The works by Jud and Winkler (1995) and Chin (2001) will be the foundation of my work. Financial theories like weighed average cost of capital (WACC) and capital asset pricing model (CAPM) will be used to explain the variation of cap rate. Capital market returns, i.e. the cost of debt and return on equity will be the subject of the model. The effect of expected rental growth will also be identified by the model.

The aim of the model is to study the effect of different determinants on the cap rates during different market conditions. Three test periods will be studied by the model; they are the normal ups and downs market cycle, the boom market and the slump market. Towards the end of this chapter, I will give my expectation on the results before doing the empirical test in next chapter.

5.2 The Model

As the cap rate is the core of this study, I will follow the logic of Jud and Winkler (1995) in developing the relationship of cap rate with the capital market returns. Understanding the mechanism in property and capital investment markets is crucial to our study. In Chapter 3, we have got detailed researches on the property valuation method and stock market performance. The connection between cap rate, Weighted Average Cost of Capital (WACC) and Capital Asset Pricing Model (CAPM) will derive our model of cap rate.

Capitalization rate

Starting from the most fundamental interpretation of cap rates, the cap rate (C) is equal to the first year net operating income (NOI_1) divided by the value of the property (V). Empirically, it is represented by:

$$R = \frac{NOI_1}{V} \quad (1)$$

The net operating income is usually calculated from the rental value of the properties. As the expense involved in renting the property is usually a constant sum, we can ignore the effect of the expense for the purpose of this study. The property valuation is based on the sales price of the property in a competitive market.

Capitalization rate vs The required rate of return

In Chapter 3, we have explained the difference between the cap rate and the required rate of return(r). It is a very important point to understand because even experienced researchers like Ambrose and Nourse (1993) will make error in equating cap rate and the required rate of return. As pointed out by many other researchers (Brueggeman and Fisher, 1993), cap rate is not the required rate of return as it does not consider changes in projected future income. Detailed analysis on this point has been made in previous chapters.

In short, the value of a property is estimated as the present value of a perpetual stream of future net operating income cash flows using discount rate (r) and expected income growth (g): (Jud and Winkler, 1995)

$$V = \frac{NOI_1}{r - g} \quad (2)$$

Substituting (1) into (2) and rearranging the terms, we will know that cap rate is equal to required rate of return minus the expected growth rate. It is consistent with many other researches. (Major, 1990; Chai, 1996; Frew & Jud, 2003). Mathematically, it is : $C = r - g = \frac{NOI_1}{V}$ (3)

Weighted Average Cost of Capital

We have studied the weighted average cost of capital in Chapter 3. The basic formula

is given by:

$$WACC = K_E \frac{E}{V} + K_D (1 - T) \frac{D}{V} \quad (4)$$

The WACC is equal to the weighted average of the cost of equity (K_E) and the cost of debt (K_D). V represents the total value of the firm which is equal to totally equity input (E) plus the total debt (D) of the company. "1-T" represents the tax shield effect of debt.

For the simplicity of this study, the effect of tax shield will be ignored. It is expected that ignoring the effect of tax shield will not affect our study on cap rate as Forland (1987) suggested that the impact of taxes will depend on how many tax-advantaged investors are trading in the market and the combined valuation of their tax benefits; unless expectations of tax benefits change, cap rate variations due to this source should be minimal. The result confirmed that the tax shield effect will only affect the cap rate in the year with significant tax changes. In other words, minor changes in tax system will not impose much effect on the variation of cap rate.

As we noted that, the taxation system in Hong Kong is quite simple and it did not undergo much change in the past decades. Therefore, ignoring the tax shield effect is justifiable and is expected not to affect our study on cap rate. By taking away the tax shield effect, the WACC model will be in the traditional form of:

$$WACC = K_E \frac{E}{V} + K_D \frac{D}{V} \quad (5)$$

Furthermore, if a company's capital is composed of the debt and equity only, value of the equity will be equal to the value of company minus the value of debt. Then, WACC will become:

$$WACC = K_E * (1 - \frac{D}{V}) + K_D \frac{D}{V} \quad (6)$$

Linking capitalization rate with WACC

WACC is widely used in the financial context. It is usually used as a hurdle for a company to assess whether to accept a project or not. When the company is choosing among different projects having similar nature and risk of their existing projects, she will only accept those with return rate higher than the company's WACC. Therefore, WACC can be used to represent the required rate of return of an investment. In equation 3, we know that cap rate is equal to required rate of return minus expected rental growth. By subsisting WACC into the required rate of return, we have:

C = r-g = WACC – g (7)

Then, we can further combining equation (6) and (7), we get:

$$C = \frac{D}{V} r_D + \left(1 - \frac{D}{V}\right) r_E - g \quad (8)$$

Capital Asset Pricing Model (CAPM)

In equation (8), the return on debt can be assessed by the market borrowing rate. What remains unknown is the return on equity. The CAPM developed in the finance market is used to estimate the require return of investment in the financial market. Therefore, we can use the CAPM to evaluate the return on equity. The simple form of the model is in the form of the following:

$r_E = r_f + (r_M - r_f)\beta_i$ (9) where $\beta_i = \frac{Cov(r_E, r_M)}{Var(r_M)}$

r_E denotes the expected return on security i

r_f denotes the risk-free return

r_M denotes the expected return on the market portfolio

β_i denotes the systematic risk of security i relative to the market risk

The equation demonstrated the theory of CAPM that the required return on investment should be equal to the risk free return and the risk premium with respect to the type of investment involved.

By using CAPM, we can have reliable estimate on the return on equity (r_E). By substituting equation (9) into (8), we have

$$C = \frac{D}{V} r_D + \left(1 - \frac{D}{V}\right)\left(r_f + \beta(r_M - r_f)\right) - g \quad (10)$$

Rearranging the terms, then we get:

$$C = r_f + \frac{D}{V}(r_D - r_f) + \left(1 - \frac{D}{V}\right)\left(r_M - r_f\right)\beta - g \quad (11)$$

Further rearrangement:

$$C - r_f = \frac{D}{V}(r_D - r_f) + \left(1 - \frac{D}{V}\right)(r_M - r_f)\beta - g \qquad (12)$$

Three component analysis

The equation (12) at the above seems to be very complicated. In fact, if we disregard the mathematical terms and look into the meanings of the equation, we can summarize the equal into 3 components.

The first component $\frac{D}{V}(r_D - r_f)$ is called the debt component. It measures the effect of the debt market return on the variation of capitalization rate. The measurement is in terms of the debt spread which represents the difference between debt market returns and the risk-free return.

The second component $\left(1 - \frac{D}{V}\right)(r_M - r_f)\beta$ shows the effect of equity market return on the cap rate. It is measured in the form of equity spread which means the difference between market returns and the risk free returns. The equity spread has to be adjusted by β which shows the risk relationship in investing in the type of investment versus the investment in the market portfolio.

The third component in the model is the expected rental growth component. It is essential to include this variable as previous researches showed that the growth component is the key for the differences between the WACC and cap rates.

Therefore, the excess cap rate (EXCSCAP) is equal to the equity spread (EQTSPRD) plus the debt spread (DEBTSPRD) minus the expected rental growth (EXPG)

Following the logic of Evans (1990) and Jud and Winkler (1995), I use the two-period lagged variable instead of the current period variable. This can reflect the information inefficiency of the property market.

My research model will be in the form of:

EXCSCAP = $\alpha + \chi_1 EQTSPRD_{t-2} + \chi_2 DEBTSPRD_{t-2} + \chi_3 EXPG + \varepsilon$

α is the intercept constant

ε is he disturbance term

This model is developed from the logic of Jud and Winkler(1995) and the expected rental growth term is included so as to increase the accuracy of the model.

5.2 Testing Period and Expected Results

Chin (2001) did a similar research on cap rates in Hong Kong from the period 1980 to 1998. Surprisingly, the results were not quite consistent the results of previous researches done in other countries. Chin found that the debt spread did not significantly affect the variation of cap rate in Hong Kong. However, nearly all of the previous researches on cap rate in the capital market return context showed a positive relationship of cap rates with the debt spread. It is interesting to know the reason behind.

Did the result of Chin (2001) show that debt spread should not be considered in

studying the cap rate in Hong Kong? In order to answer this question, further research has to be done.

The highly speculative nature of the Hong Kong property market may be the reason for the insignificancy of debt spread. The testing period employed by Chin is 1980 to 1998. Within this period, the land supply is restricted to 50 hectares per year after the announcement of the Sino-British Joint Declaration in 1984. The property value was inflating irrationally since then. The increase of property price is even crazier in the 1990s' until 1997. Irrational speculation in the property market may distort the value of the property market and making the theoretical market value largely different from the market price. (Li, 1999)

In order to investigate the determinants of cap rates in Hong Kong, the period from 1991 to 2003 will be tested in this study. The effect of debt spread, equity spread and expected rental growth will be studied. In this period, the property value has undergone large inflation and then substantial depreciation. From the period 1991 to 1997, the property value increase in a crazy manner. However, after 1997, the property value drops in every year and has decrease for about 70% from the peak in 1997. If the cap rate as interpreted by the WACC and CAPM is true, the movement of the capital market returns will be like this:

Table 5.1 Expected results for the period 1991-2003

Variable Name	**Variable Definition**	**Expected Sign**
α	Intercept point	N/A
$EQTSPRD_{t-2}$	Equity Spread with two period lag	+
$DEBTSPRD_{t-2}$	Debt Spread with two period lag	+
$EXPG$	Expected rental growth	-
ε	Error Term	N/A

Following the logic of Froland (1987), cap rates are in part a function of investor requirements for current returns, which means that they must be competitive with risk-adjusted money market returns. The equity spread and debt spread should then have a positive relation on the variation of cap rate. As the investment in capital market and property market is in fact competing in nature, if there is increase in the equity spread or debt spread, the investors in the property market will also request a higher cap rate. This is consistent with the results of many previous researches. (Parker, 1994; Jud and Winkler, 1995; Frew and Jud, 2003)

1991-1997

In the period 1991 to 1997, the property market is highly speculative. If the interpretation of Chin(2001) is correct, the investors will buy property irrationally and disregard the investment theories like CAPM and WACC. Then, the effect of debt spread and equity spread will not be able to explain the variation in cap rate. Therefore, we can difficultly predict the result in this period.

If the result shown in this period still consistent with the traditional view as suggested by Froland (1987) and Jud and Winkler (1995), it implies that the investor still follow the logic of CAPM and WACC even in a boom market.

Table 5.2 Expected results for the period 1991-1997

Variable Name	Variable Definition	Expected Sign
α	Intercept point	N/A
$EQTSPRD_{t-2}$	Equity Spread with two period lag	To be determined
$DEBTSPRD_{t-2}$	Debt Spread with two period lag	To be determined
$EXPG$	Expected rental growth	-
ε	Error Term	N/A

1998-2003

The property market in Hong Kong is in a slump in this period, the property value and rental value for all sectors of properties drop in every year. If people want to invest in the property market, they should perform rationally and obey the rules in the investment field. The debt spread and equity spread are expected to have effect on the cap rate. If the model can apply in Hong Kong, the correlation between cap rate and debt spread or equity spread should be the same as other researches.

Table 5.3 Expected results for the period 1998-2003

Variable Name	Variable Definition	Expected Sign
α	Intercept point	N/A
$EQTSPRD_{t-2}$	Equity Spread with two period lag	+
$DEBTSPRD_{t-2}$	Debt Spread with two period lag	+
$EXPG$	Expected rental growth	-
ε	Error Term	N/A

Chapter 6

Data and Source

6.1 Introduction

In previous chapters, we have reviewed the merits and inadequacies of previous researches on cap rates. The model for our study has been set up. The testing period of our study will be from 1991 to 2003. The analysis will be divided into 3 sessions—(1) the year from 1991 to 2003, (2) the year from 1991 to 1997 and (3) from 1997 to 2003. The period is chosen because the Hong Kong property market suffered both ups and downs in this period. Studying this period can help to understand the performance of capital market returns in explaining the movement in cap rates.

From the model we have set up in Chapter 5, we have to collect data in 4 main areas: capitalization rates, rates related to debt spread, rates related to equity spread and also the expected growth rate. The type of data required will be discussed in this chapter and the source will also be identified.

6.2 Scope of Study

Research by Evans (1990) has shown clearly that property characteristics will vary across both property type and property locations. The results from their study indicated that differences across property types are important in evaluating cap rates.

They warned that failure to account for the different across property types can lead to biased results. Therefore, we will also divide our study into different property segments—**the retail, industrial** and **office** sector. These 3 sectors are chosen because they hold higher similarity with the investment characteristics in the financial market. The investors holding these types of property are usually expecting the return in rental income rather than using the property themselves. The residential sector is not going to be investigated because many of the residential flats are held by and occupied by the owner themselves. This factor may affect the accuracy of our study as the properties are not holding for investment purpose.

Therefore, we will study the cap rate in retail, industrial and office sector in Hong Kong.

6.3 Property Index

The primary source of data will be the market yield published quarterly by the Rating and Valuation Department of Hong Kong. According to the Technical Notes of the department, market yield is derived by comparing the average rent/rateable value and price/rateable value factors. This figure is a good proxy for the capitalization rate of different market sectors because it coincides with the definition of capitalization rate.

From my previous researches, most of the data used in previous researches were

obtained from the American Council of Life Insurance (ACLI) quarterly Investment Bulletin. (Ambrose and Nourse, 1993; Evans, 1990; Froland, 1987). ACLI tracks mortgage data for about two-thirds of the commercial mortgages held by the U.S. life insurance companies. Using data from the Rating and Valuation Department of Hong Kong is compatible with the ACLI, as the indices issued by the Rating and Valuation Department is derived from real transaction data. The soothing problem arising from the appraisal-based property data could be avoided. Also, the department has been keeping a very good set of data from the early 70's, using the index provided by them is very reliable.

6.4 Debt Spread Factors

In the model, the debt spread factor is represented by the term $\frac{D}{V}(r_D - r_f)$. Therefore, the risk-free return and cost of debt are essential for our study. Both rates can be obtained in the market quite easily.

Risk-free return

Risk-free return refers to the return in the kind of investment that has no risk of default. Basically, only the securities offered by some large countries can be regarded as free of default risk. Therefore, the risk-free return usually refers to the U.S.

government bond or Treasury Bill.

In previous researches, when the authors need to assess the risk-free return, they will refer to the U.S. Treasury Bill (T-bill). As suggested by Petros et al (2001), we should refer the risk-free rate to the 10-year T-bill rate. He claimed that the conventional view of real estate is a kind of long-term investment; the 10-year treasury works better than other rate in studying the cap rate. His view is supported by Sharpe (1999) who explained the importance in matching the holding period in comparing the investment risk. Therefore, we have to choose the 10-year treasury rate with closer holding period as the property investment. The 10-year treasury rate should be chosen as reference of the risk-free return.

It is difficult to find an appropriate reference of risk-free return in Hong Kong, because until now, the government has not issued any bond. The only data available is the Exchange Fund Note issued by the Hong Kong Monetary Authority. Actually, it should be a good reference to risk-free return as the note is fully backed by the Foreign Exchange Fund. The risk of default is minimal as the Foreign Exchange Fund currently has a balance of about US$100billion. However, the 10-year Exchange Fund Note is only available starting from October of 1996. We do not have sufficient data for my testing period.

It is reasonable to use the 10-year treasury rate issued in the United State as a proxy of the risk-free rate in Hong Kong. As Hong Kong dollar is pegged to the U.S dollar since 1984, the interest rate of them should be approximately the same. 10-year treasury rate can then proxy the risk-free rate in Hong Kong.

Cost of Debt (r_D)

The cost of debt is an important factor affecting the cap rate. As shown in the previous researches, all of them shown that there is positive correlation between the cost of debt and cap rate. Froland (1987) used the mortgage yield to proxy the cost of debt with the view that people usually finance their property investment through mortgages, therefore, using mortgage yield to proxy the cost of debt of the property investors is the best choice.

Jud and Winkler (1995) proxy the cost of debt by BAA-rated bond. They did not propose any reason for such proxy. From my analysis, I think the rationale is based on the assumption that the institutional investors may choose to issue bonds to finance their investments; therefore, the BAA-rated bond can be used as proxy.

In Hong Kong, we do not have the specific mortgage rate to the investment properties; the property-type specific mortgage yield is not available. The property investors also seldom issue bonds to finance their property investment. The mean of finance is

usually from the banks. So, the best lending rate available from the bank can be a proxy for the cost of debt. Although there may be some deviation of the actual rate charged by the bank to individual property investors according to their credit rating, in average, the prime rate offered by the bank is a good proxy for the cost of debt. The data is available from the Hong Kong Census and Statistics Department.

6.5 Equity spread factor

Similar to the debt spread factor, the equity spread factor is also an important element to review the variation of cap rate. It is represented by the term $\left(1-\frac{D}{V}\right)(r_M - r_f)\beta$. We have studied the proxy for risk-free return in 6.4 and what remains now is Market return and Beta.

Market Return (r_M)

Market return refers to the return to a market portfolio. Theoretically, it should include all the securities available in the market. But in practice, a market index will usually be used to represent the market return. All the previous researches carried out in the U.S. used the *Standard and Poors* 500 common stock price index to proxy the market return. In Hong Kong, the Hang Seng Index is compatible to the Standard and Poors 500 Index. The Hang Seng Index consists of 33 constituent stocks which account for

about 80 % of the total market capitalization of the Hong Kong Stock Market. The 33 constituent stocks are come from 4 sectors: Finance, Utilities, Properties and Commerce and Industry. The 33 constituent stocks as per 9-6-2003 are as follows:

Finance Sector (4 stocks)	***Utilities Sector (3 stocks)***
HSBC Holdings plc Hang Seng Bank Ltd. Bank of East Asia, Ltd., Bank Of China Hong Kong (Holdings) Ltd	China Light Power Holdings Ltd Hong Kong and China Gas Co. Ltd Hongkong Electric Holdings Ltd
Properties Sector (6 stocks)	***Commerce & Industry Sector (20 stocks)***
Cheung Kong (Holdings) Ltd Henderson Land Development Co. Ltd Sun Hung Kai Properties Ltd. Wheelock and Co. Ltd. Henderson Investment Ltd. Hang Lung Properties Ltd	Wharf (Holdings) Ltd Pacific Century CyberWorks Ltd Hutchison Whampoa Ltd Swire Pacific Ltd. 'A' MTR Corporations Ltd Johnson Electric Holdings Ltd. CITIC Pacific Ltd. China Resources Enterprise, Ltd Cathay Pacific Airways Ltd. Esprit Holdings Ltd. Shanghai Industrial Holdings Ltd. Li & Fung Ltd. Television Broadcasts Ltd. Yue Yuen Industrial (Holdings) Ltd. China Unicom Ltd. CNOOC Ltd. China Mobile (Hong Kong) Ltd. Legend Group Ltd. Cheung Kong Infrastructure Holdings Ltd. COSCO Pacific Ltd.

Source: *HIS Services Limited*

Heng Seng index is usually taken as the primary reference of the performance of Hong Kong Stock Market. It is a good proxy of the market return. The data is available from the Hong Kong Monthly Digest of Statistics by the Hong Kong Census and Statistics Department.

Beta (β)

As we have reviewed in previous chapters, the beta value (β) show the risk relationship between the property market and the financial market. In mathematical term, it is represented by the formula:

$$\beta = \frac{Cov(r_E, r_M)}{Var(r_M)}$$

It is the covariance between the return on property investment and the return on market divided by the market variance.

Brown (1984) carried some research on the property β value and he has estimated the β of property investment. Furthermore, he found that the individual β value corresponding to different property type will be different, too. His findings showed that the β for Office is largest followed by retail properties and the industrial buildings is the least. However, the result cannot be used in this study because the research carried out by Brown is in the U.K. basis, the investment market condition will be very different from that in Hong Kong. Furthermore, the research was carried out in 20 years ago, the property of the investment market may have changed a lot. It

is not preferable to use the result of Brown.

As there are no similar research carried out in Hong Kong, we cannot find a reasonable proxy of the β. We can only assume the effect of β is constant so that we can ignore the variable β.

Capital Structure

The capital structure of the investors will affect the weighted average cost of capital and in turn the cap rate. Therefore, it is important to include this term in our study.

The capital structure reflects the relative debt and equity mix in a company, this kind of information is available from the balance sheet of the listed firms. As such, by reviewing the balance sheet of the listed property investment firms (like Henderson), we can get the information of total debt and equity of the firms. These can be used as proxy of capital structure of property investors.

6.6 Expected growth

Some researches have addressed the importance of expected rental growth on the variation of cap rates and different methods are used to proxy it. Froland(1987) measured the expected rental growth in terms of the inflation expectation. He used the spread between short and long-maturity interest rates to estimate the expected

inflation rate because it can indicate the market judgments as to whether inflation may be increasing or decreasing in the future. However, this kind of analysis is not available in Hong Kong because the 10-year Exchange Fund Note is not issued until 1996. We cannot compare the short term and long term interest rates.

Chau (1997) supported the use of expected inflation as proxy for expected rental growth. Petros et al.(2001) suggested to use the changes in general Consumer Price Index (CPI) to estimate the inflation rate. He claimed that using CPI is a better proxy for inflation rate as compared with other measures.

My study will follow the logic of Petros et al (2001) and use the changes in the composite Consumer Price (CPI) Index to estimate the expected inflation. The composite CPI measures the price changes in a basket of consumer goods like food, clothing and housing expense. The data is available from the Monthly Statistics published by the Hong Kong Census and Statistics Department.

It is expected that the expected rental growth will have a negative impact on capitalization rates, as expectations of higher inflation and, hence, higher nominal rent growth would motivate investors to accept a lower income return at the time when they purchase the property.

Chapter 7

Empirical Results and Discussion

7.1 Introduction

According to the theories and model discussed in previous chapters, empirical testes have been carried out to study the determinants of capitalization rate in Hong Kong. Regression analyses are performed in 3 time series: (1) from the first quarter of 1991 to the forth quarter of 2003, (2) from the first quarter of 1991 to the forth quarter of 1997 and (3) from the first quarter of 1998 to the forth quarter of 2003. The study of cap rate is further divided into different property types: office sector, industrial sector and also the retail sector.

Through the analysis of different property segments, the determinants affecting the cap rate of a particular property type can be found out. Also, by carrying out the analysis in different period, the performance of the cap rate determinants can be studied according to different market conditions.

7.2 Test Statistics

Three Test Statistics will be used in this chapter. They are t-statistics(P-value), coefficient of determinants (R^2) and Durbin-Watson test (D-W test). We will use these statistics test to interpret our results.

T-test (P-value)

T-test or P-value are frequently used as reference to see whether an independent variable is significant on the dependent variable. The T-test/P-value can tell the likelihood that the dependent variable is affected by the independent variable. P-value can suggest the chance that an estimated coefficient will be zero. Usually, the smaller the P-value, the more significant is the result.

In this study, we define the independent variable to be significant if they are significant at 10% or even lesser.

Coefficient of determinants (R^2)

R^2 indicates the proportion of variation in the dependent variable explained by the variation in the independent variables. It is used as a measure of goodness of fit. Magnitude of R^2 ranges from zero to one. The closer to one, the higher the proportion of variation in the dependent variable can be explained by the variation in the independent variables. If the following results show R^2 is very close to one, that means the independent variables in the model can explain the variation in cap rate well.

Durbin-Watson test (D-W test)

D-W test is used to test the existence of first order correlation exist in the regression

model. The value of D-W test ranges from zero to four. The closer the D-W value to 2, the less likely that there is first order auto-correlation. An autoregressive term may need to be added into the model to adjust the problem of auto-correlation.

7.3 Empirical Results and Discussion

7.3.1Period: 1st quarter, 1991 to 4th quarter, 2003

This period is a very good testing period as the property market has undergone ups and downs, boom and burst in this period. Testing result should be able to represent the prediction under our model.

Table 7.1 Empirical results for the period 1991 to 2003:

Variable	*Office*	*Industrial*	*Retail*
DEBTSPRD-2	0.580407*	0.477078*	0.417452*
(P-value)	*(0.0002)*	*(0.0015)*	*(0.0006)*
EQTSPRD-2	-0.007644**	-0.003113	-0.002973
(P-value)	*(0.0651)*	*(0.4353)*	*(0.3456)*
EXPG	-0.048577**	-0.044555**	-0.035136**
(P-value)	*(0.0436)*	*(0.0604)*	*(0.0610)*
Adjusted R^2	0.881566	0.965216	0.932001
Durbin-Watson test	1.820774	1.961129	1.884165

* Significant at 1% level

** Significant at 10% level

7.3.1.1 Office Sector

The result obtained for the office sector is quite satisfactory. We can see from the value of adjusted R^2 that over 88% of the variation in the excess cap rate can be explained by the independent variable in the model, i.e. the Debt spread, equity spread and the expected rental growth. It supported the hypothesis that cap rates in the office sector are related to the capital market returns.

In the model, an autoregressive term has been added to adjust the problem of first order autocorrelation. After adding the autoregressive term, the D-W test result increase to about 1.82. It is quite close to 2 meaning that the problem of first order autocorrelation is not very serious. The regression results will not be biased in this case.

i) The effect of debt spread variable (DEBTSPRD-2)

The debt spread variable is determined by the return on debt and risk-free return. Consistent with my prediction and the result of previous researches(Froland, 1987; Jud and Winkler, 1995), debt spread is positively related to the cap rate. In order words, the cost of debt will positively affect the cap rate. Also, just as predicted from the result of Evans (1990), there is lagging effect on the variation of cost of debt to the variation of cap rates.

The P-value of the debt spread is as low as 0.0002, it represents that the cost of debt is significant at 1% level. Therefore, we are sure that the cost of debt will affect the cap rates in the office sector of Hong Kong.

ii) The effect of equity spread variable (EQTSPRD-2)

The variable of equity spread represents the effect of equity return in the capital market. In theory, it should be positively related to the cap rate as predicted from the result of Froland (1987) and Jud and Winkler (1995). The reason suggested is that, property investment is a kind of investment, so, it should be completive to other equity investment in the market. The higher the return on equity available in the market, the higher the cap rate should be.

However, as we can see from our results, the equity return in the capital market is negatively related to the cap rate of office sector. It means that the higher the equity return, the lower is the required cap rate. It is not consistent with my prediction derived from the WACC and CAPM concept. Interestingly, this negative relationship is also shown in the result of Ambrose and Nourse (1993). They found that the stock earnings/price ratio is negatively related to the cap rate. This kind of negative relationship is further confirmed by the research of Lai (1996). He examined the determinants of the cap rate of office properties in Hong Kong by establishing a

regression model using various market variables to measure the tread of office cap rate in Hong Kong. His result showed that the performance of Hang Seng Index is negatively related to the cap rate in Hong Kong's office sector. It seems that the relationship between office cap rates and equity market returns cannot be explained under the philosophy of Froland (1987) and Jud and Winkler (1995).

iii) The effect of expected rental growth variable (EXPG)

The result of the expected rental growth variable is consistent with our predication. The regression result shows that cap rates are negatively related to the expected rental growth as proxy by inflation. The hypothesis that expected rental growth will compensate part of the required return of an investor is proved. The result is significant at 5% level meaning that the expected rental growth is very likely to affect the cap rate in office sector.

7.3.1.2 Industrial Sector

The result obtained in the industrial sector is very satisfactory. As the value of R^2 is 96.5%, it shows that most of the variation in the cap rate of industrial sector can be explained by the independent variables of the model. The D-W test after adding an auto-regressive term is 1.96. We can almost ensure that there is no first order auto-correlation.

i) The effect of debt spread variable (DEBTSPRD-2)

Similar to the result obtained in the office sector, the industrial sector's cap rate is also positively related to the cost of debt. P-value is also very low; it is significant at the 1% level. Cost of debt is positively affecting the cap rate in industrial sector.

ii) The effect of equity spread variable (EQTSPRD-2)

According to the literatures that we have reviewed in Chapter 4, the return in the equity market should bear a positive relationship with the cap rate. Increasing the equity return in the capital market should induce increase in the cap rate as the investors will compare their return on investment in different aspects. However, the result in this study shows that the P-value of equity spread is as high as 0.4353; it means that the equity return is not significant in explaining the cap rate movement in

the industrial market. Sin (2000) got a similar result in her study and she found that there is no significant relationship between the volatility of property market and that of the stock market. It seems that the cap rate in industrial sector is not affected by the equity return in the capital market. The lack of relationship may suggest that the investors in the industrial properties may be independent from the capital investment market. They are specialized in the investment of income generating industrial properties. Their investment pattern will not be affected by the equity return market because they will not invest in the equity market as an alternative. The property investors may not be familiar with the investment in the equity market so they will not choose the equity market as an alternative investment opportunity and will make no reference to the equity return in capital market. The equity return seems not to be a significant determinant in the industrial cap rate in Hong Kong.

iii) The effect of expected rental growth variable (EXPG)

Consistent with the result from previous researches, the expected rental growth will have a negative impact on the cap rate of industrial sector. It is significant at the 10% level. This result is the same as that in the office sector meaning that both the cap rate in office sector and industrial sector move in an opposite direction with the expected rental growth.

7.3.1.3 Retail Sector

The results obtained in the retail sector are also very good. The independent variables in the model can explain 93% of the variation in retail cap rate. The problem of first order auto-correction can largely be adjusted by adding an auto-regressive term into the model. D-W test show that the first order auto-correlation problem should not be very serious although there is some tendency for positive correlation. In general, the model works very well in this sector.

i) The effect of debt spread variable (DEBTSPRD-2)

Again, the cost of debt shows a positive relationship with the retail cap rate. The P-value also tells the cost of debt is very significant in determining the cap rate. When cost of debt increase, higher cap rate is required and vice versa.

ii) The effect of equity spread variable (EQTSPRD-2)

The cap rate of retail sector shows the same pattern as that of the office sector. The P-value suggested that there is no significant relationship between the cost of equity and the retail cap rate. Similar reason as the industrial sector can be used to explain this phenomenon.

iii) The effect of expected rental growth variable (EXPG)

In the retail sector, the expected rental growth is again negatively related to the cap rate. It is consistent with our knowledge that cap rate is equal to the required rate of return minus expected growth.

7.3.1.4 Concluding Remark

In all the 3 sectors of the property market, the cost of debt and expected rental growth are proved to relate to the movement of cap rate. It satisfies with our prediction and the results of previous researches. It suggested that these two factors are always being considered when the investors determine the cap rate. In contrast, the equity return in the capital market may not be an important factor for the property investors to figure out the cap rate. It seems that only the investors in the office sector will take account of the equity return when they determine the cap rate. For the other two sectors, there are no significant relationships between the cap rates and equity returns.

7.3.2 Period: 1st quarter, 1991 to 4th quarter, 1997

During this period, the Hong Kong property market is booming. The property price went up every day and people become crazy in investing in the property market. The market was highly speculative, investors may behave irrationally. Studying the determinants of cap rate in this period will tell us whether our model can still apply in the boom market in which people may not invest according to the financial theories.

Table 7.2: Empirical results for the period 1991-1997:

Variable	*Office*	*Industrial*	*Retail*
DEBTSPRD-2	0.575883*	0.711198*	0.403308**
(P-value)	*(0.0057)*	*(0.0002)*	*(0.0275)*
EQTSPRD-2	0.000245	1.24E-05	0.001059
(P-value)	*(0.9637)*	*(0.9981)*	*(0.8074)*
EXPG	-0.058495**	-0.070107**	-0.038485
(P-value)	*(0.0984)*	(0.0716)	*(0.1802)*
Adjusted R^2	0.724701	0.764572	0.619188
Durbin-Watson test	1.835688	1.938308	1.769669

* Significant at 1% level

** Significant at 10% level

7.3.2.1 Implications

As expected by our previous analysis, the model's explanatory power on the variation of cap rate decreased a lot in this period. In comparing with the result obtained in Table 7.1, the R^2 value decreased from 80-90% to 60-70%. It shows that lesser variation in cap rates can be explained by the model in the period 1991 to 1997. All the results in the 3 sectors share the same phenomenon. It implies that there are some other factors, not being identified in the model, are affecting the variation in cap rate in this period. The factors may mainly due to the irrational behavior of the property investors in making their investment decision.

i) Debt spread (DEBTSPRD-2) and Expected Rental Growth (EXPG)

Although the explanatory power of the model is not as high as before, we can still see that the debt spread and expected rental growth variables are the important factors in determining the cap rate.

The results show that the costs of debt in all the 3 sectors are significant in 1% level. It means that the costs of debt are very significant in affecting the variation of cap rates. In consistent with the results obtained in Table 7.1, the cost of debt has a positive relationship with the cap rate. The results suggest that, the cost of debt is still an important factor in determining the cap rate even in the boom market.

For the expected rental growth variable, it still shows a significant effect on the variation of cap rate in 10% significant level. Both the cap rate of office sector and industrial sector is negatively related to the expected rental growth. Only the result in the retail sector shows an insignificant relationship between expected rental growth and the cap rate.

ii) Equity spread variable (EQTSPRD-2)

Similar to the result obtained in the period 1991 to 2003, the equity spread component is not significantly affecting the rate. The insignificancy is even higher than before. In Table 7.2, we can see that the P-vales in the equity spread are ranging from 0.8 to 0.99, it strongly suggested that the return in the equity market is not a determinant of the cap rate during the period 1991 to 1997.

The property market inflated every day from 1991 to 1997, the investors form a perception that investing in the property market can get a "guaranteed" return and the return is very high, too. In comparing with the stock market in that period, although the general trend was also a booming market, there was some ups and downs. People will think that investing in the property market is a "must win" game while investing in the stock market is still subject to some risk of ups and downs. Therefore, the property investors will not treat the equity market as an alternative to the property

investment so they take no account into the stock market when they formulate their investment decision. This is the reason why the equity return is not affecting the cap rate in this period.

7.3.3 Period: 1st quarter, 1998 to 4th quarter, 2003

In this period, the Hong Kong property market is generally in a slump. After the Asian financial crisis, property values keep dropping every day since 1998. According to our hypothesis, our model should restore its explanatory power in this period as the people should invest rationally. The market condition is not good, so the people will choose their investment carefully and behave according to the long established financial theories.

Table 7.3 Empirical results for the period 1998-2003

Variable	*Office*	*Industrial*	*Retail*
DEBTSPRD-2	0.401224**	0.347770	0.399745**
(P-value)	*(0.0898)*	*(0.1993)*	*(0.0224)*
EQTSPRD-2	-0.017957**	-0.008146	-0.009365**
(P-value)	*(0.0104)*	*(0.2804)*	*(0.0519)*
EXPG	-0.055678	-0.046692	-0.038527
(P-value)	*(0.1058)*	*(0.2382)*	*(0.1201)*
Adjusted R^2	0.817332	0.748743	0.870084
Durbin-Watson test	1.874595	1.887855	1.966323

** Significant at 10% level

7.3.3.1 Implications

In this period, the R^2 increased to around 80%. The model is able to explain 80% variable of cap rate. It matches with our hypothesis that people will behave according to the financial theory in the slump market.

The model gives very good result in this period with the exception of industrial sector. In this sector, only 75% variation in the cap rate can be explained by the model. Also, all the three variables: debt spread, equity spread and the expected rental growth are not significant at 10% level. It suggests that the 3 variables do not have significant relationship with the cap rate. The dissatisfactory result may be due to the limited transaction in the industrial premises during that period. As most of the factories have been moved to the mainland China in the 1990s', there are lesser and lesser manufacturers remain in Hong Kong. The market demand for the industrial premises is very small as there is not much factory remain in Hong Kong. Therefore, our model may not be able to explain the cap rate in the industrial sector. In our analysis below, we will disregard the industrial sector.

For the office and retail sector, the results are quite good and are able to explain many of our assumptions.

i) Debt spread variable (DEBTSPRD-2)

The results in all the office and retail sectors demonstrated that the debt cost is again an important factor affecting the cap rate. The results confirmed with the model that the higher the cost of debt, the higher is the cap rate. There are significant positive relationship between cap rate and cost of debt in the 10% level.

ii) Equity spread variable (EQTSPRD-2)

The results in the office sector and retail sector both demonstrate a negative relationship between the cap rate and the equity return. In contrast to the result that we get in the period 1991-1997 (Table 7.2), the investors do consider the equity return in making up their cap rate. It proved our hypothesis that in a slump property market, investors will be more careful in their investment and follow the conventional wisdom of investment.

One interesting thing to note is the cap rate in the retail market. When we look at the result obtained from the period 1991-2003 (Table 7.1), the equity return is not significantly related to cap rates. However, when we look at our result in this period (Table 7.3), there is significant relationship between the equity returns and cap rate. The difference may suggest that the retail property investors, who do not care about the stock market before, are now keeping an eye on the equity return in the capital market. It means that during the hard time of the property investment market, people

will find other investment opportunities. Investors' decisions go back to the fundamental principle that property investment is just a kind of investment.

iii) Expected rental growth variable (EXPG)

From the results in Table7.1 and Table 7.2, we can see that in both the normal market and boom market, the expected rental growth will have a significant negative relationship with the cap rate. It confirms the theory that cap rate is equal to require return minus growth rate. However, we can see our results in Table 7.3, it shows that during 1998 to 2003, the expected rental growth is not very significant in explaining the cap rate. (P-value is about 0.1 to 0.12). The possible reason may due to the continuous deflation happen in the period. From 1998 onward, Hong Kong is suffering more than 50 months deflation; the continuous deflation will affect the perception of investors on the expected rental growth. It may violate the assumption of rental growth in our model. Therefore, the expected rental growth does not have a significant relationship with the cap rate in this period.

7.4 Conclusion

In this chapter, our model has been tested in 3 periods: 1991-2003, 1991-1997 and 1998 to 2003. The results show that the cost of debt is always an important factor in explaining the variation in cap rates. It works in all the situation of ups and downs

markets. Investors will take into consideration of this factor when they formulate their investment cap rate.

The effect of equity spread is quite fluctuating in different market conditions. In general, the property investors seem not considering the equity return on the stock market when they figure out their investment cap rate. But in the slump market, the property investors will be interested in finding other means of investment and take the equity return into their considerations. Furthermore, the relationship between the cap rate and equity return in Hong Kong should be negative rather than positive.

The expected rental growth factor also work in both the general market and the boom market in which it demonstrates a negative relationship with the cap rate. However, the effect of expected growth is questionable during the time of continuous deflation.

Chapter 8

Conclusion

8.1 Introduction

Capitalization rate is frequently used as the key indicator in property investment. During the income capitalization process, the expected income stream from the property is translated into the estimated current value. Cap rates take an essential position in this process as the estimated value of the property is calculated by dividing the net operating income by the cap rate. Because of the importance of cap rate in property investment, different studies have been carried out. This paper studies the cap rate from the financial perspective and tries to relate the cap rate with the capital market returns in Hong Kong during different market conditions.

In this chapter, we will summarize our findings of this study. Then the limitation of this study will be discussed. Further research areas will be suggested towards the end of this chapter.

8.2 Summary of findings

In this study, we have reviewed the theoretical concept of cap rates and the related financial theories. Relationship between cap rates, weighted average cost of capital (WACC) and capital asset pricing model (CAPM) have been investigated. In short,

cap rates equal to WACC minus the expected growth rate. The equity component of the WACC can then be estimated by the CAPM. By linking up cap rates with WACC and CAPM, capital market returns, i.e. the cost of debt and return on equity, are introduced to study the variation of cap rates (Chapter 3, 4, 5)

The merits and inadequacies of previous researches have also been identified. (Chapter 3) In general, previous research results showed a positive relationship between cap rates and capital market returns while the expected rental growth is negatively related to cap rates. However, no previous researcher has conducted his study specific to different market conditions. The effect of the determinants during different market conditions remains unknown.

In our study, a model, making use of the concept of WACC and CAPM, was set up to study the relationship between capital market returns and the cap rate. (Chapter 5) Three independent variables: return on capital, return on equity and expected rental growth are tested with cap rates. Following the findings of previous studies, this study is divided into different property sectors. The study period is from 1991 to 2003, and then it is sub-divided into 2 periods: 1991 to 1997 and 1998 to 2003. It aims to study the effect of the determinants during different market conditions.

The results of the study point to 3 conclusions:

1) The debt spread variable is always an important factor in affecting the variation of

cap rates no matter in which kind of properties and in what market conditions. In all the 3 sectors under investigation, i.e. the office, industrial and retail sector, the cost of debt is affecting their corresponding cap rate. Also, the results are consistent in the study of 1991 to 2003, 1991 to 1997 and 1998 to 2003. That means the cost of debt is significantly related to the cap rate positively. The cost of debt is always a factor affecting the investors' determination of cap rate in all circumstances.

2) The effect of equity spread on the cap rate is not the same in different market conditions. During the period from 1991 to 1997, i.e. the boom market, the return on equity in the capital market is not significantly related to the cap rate in all sectors. The result implies that the investors will not consider the equity return in the capital market when the property market condition is good. The result contradict with the theory of Froland (1987) in which he suggested that cap rates will depend upon competitive, alternative returns on other real and financial assets, not just among real estate opportunities.

   The insignificancy of equity returns on cap rates may be due to the irrational market condition during 1991 to 1997. The property investors have believes that the property market will keep increasing forever. In comparing with the stock market, there is still seasonal fluctuation during the boom market. When the

investors have to make a choice between the stock market and the property market, they will choose property market without looking at the equity return in the capital market because they think that there is no risk of lose in the property market. With the illusion of ever increasing property price, the equity return is no longer a determinant.

The return on equity restores its effect on the cap rate in the slump property market. The result in the period 1998 to 2003 shows that the equity spread has significant relationship with the cap rate in office and retail sectors. In the slump market, investors make their investment decision more carefully and they will consider all other alternatives before they make their investment. All the investment decisions will go back to the basic investment theory; therefore, the property investors consider the equity return in figuring out the cap rate.

However, the relationship between the cap rate and equity return is not the same as predicted from the result of Froland (1987) and Jud and Winkler (1995). The relationship between the cap rate and equity return is not positive but is negative. This result is supported by Ambrose and Nourse (1993) and Lai (1996). They also find a negative relationship between the cap rate and equity return in their studies. The reason for the deviation is not known but it seems that the equity return in the market is negatively related to the cap rate in Hong Kong as both Lai (1996) and

this study confirmed this relationship.

To sum up, the equity return is not significantly related to the cap rate during the boom market. The equity return is negatively related to the cap rate during slump and normal market.

3) In general, the expected growth rate has a negative relationship with the cap rate. It matches with the prediction of our model and the results of previous studies. No matter in the boom market from1991 to 1997 or the market over both ups and downs condition from 1991 to 2003, the expected growth rate has a significant negative relationship with the cap rate. The only exception is in the period 1998 to 2003, the continuous deflation in price level may have distorted some of the assumptions in our model and making the expected rental growth not significant in affecting the cap rate.

To conclude, this study followed the logic of Jud and Winkler (1995) in making use of weighted average cost of capital (WACC) and capital asset pricing mode (CAPM) to study cap rates. In contrary to many previous researches, the cap rate is not always related to the capital market returns. Equity return in the market may not be considered in the boom property market and the expected rental growth may lose its effect on cap rate during continuous deflation. Only the cost of debt is a factor that

will always be considered by property investors in making up their investment decision.

8.3 Limitation of Study

In this study, there are several limitations which may lead to inaccuracy of result. The limitations are as follows:

1) **The intrinsic difference between the property investment and capital market investment**

In this study, we have made use of a lot of theories in the financial market to assess the cap rate in the property market. However, there are some fundamental difference between investing in securities and investing in properties. The problems of divisibility, liquidity, heterogeneity, information availability etc have long been addressed to be the difference between the property market and finance market. These problems may result to some deviation of result when applying the financial model in the property market.

2) **The problem in addressing the beta value in the CAPM**

As we have studied before, the beta value in the CAPM demonstrated the risk and return relationship between the investment and the market. However, we do not know the beta value of property investment as well as the corresponding beta value in each property sectors. Without knowing the beta value, we are not able to figure out the

exact relationship between the property investment and the market return.

3) Capital structure

The capital structure is an important factor in the determination of WACC. It will then affect the cap rate directly.

In this study, we used the capital structure of the listed property investors as proxy. However, there are many unlisted property investors in the market that we cannot know their condition of capital structure. The unknown capital structure may affect our results.

4) Biased nature of stock market

We used the Hang Seng Index as the proxy of market return. Although the Hang Seng Index consists of 33 constituents, many of them are highly related to the property investment or property development. Other than the 6 stocks in the property sector, many stocks in other sectors also have heavy business on the property market, like Swire Pacific Ltd. 'A', MTR Corporations Ltd and Pacific Century CyberWorks Ltd, just to name few. The stock market is very biased to the property investment and the Hang Seng Index as a reference of market return is doubtful. Nevertheless, there is not any better proxy available in Hong Kong.

5) Data availability

In this study, some of the data obtained is not strictly the Hong Kong data. For

example, the risk free return used is proxy by the 10-year U.S. treasury rate. Although Hong Kong dollar is pegged with the U.S. dollar since 1984, the interest rates may not be exactly the same. When there is interest rate change by the Federal Reserve, the banks in Hong Kong may not follow it. The interest rate in the U.S. cannot fully represent interest rate in Hong Kong.

8.4 Recommendation of further studies

In this study, most of the results are consistent with the prediction of our model. However, our results on the equity return may need further investigations. Firstly, the regression results show that return on equity is not significantly related to cap rates during the boom market. It is contrary to many previous studies and the capital asset pricing model. Further research can be done to investigate the reason behind.

Secondly, in the time of normal market or slump market, the equity return is significantly related to the cap rate but the relationship is a negative one. It is contrary to some researches (Froland, 1987; Jud and Winkler, 1995) but consistent with others(Ambrose and Nourse, 1993; Lai, 1996). Further research can be done to investigate the reason of the inconsistent results.

8.5 Conclusion

The results of this study showed that capital market returns are not always related to the capitalization rates in all market conditions. It may be dangerous to rely on the financial theory in studying the cap rate without looking at the market condition. Irrational investors may not follow the theory in investment and distort the cap rate in the market.

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